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NEW ENGLAND DRAINAGE BASINS: A COOPERATIVE STATE-FEDERAL REPORT ON WATER POLLUTION

Public Health Service
Boston, Massachusetts

1951

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For Clean Water—"One River, One Plan"

New England
DRAINAGE BASINS

A COOPERATIVE STATE-FEDERAL REPORT ON WATER POLLUTION

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FEDERAL SECURITY AGENCY

Public Health Service

167

SUMMARY REPORT ON WATER POLLUTION

New England Drainage Basins

Prepared by

FEDERAL SECURITY AGENCY
Public Health Service
Division of Water Pollution Control
New England Drainage Basins

1951

In cooperation with:

Connecticut:
State Water Commission
State Department of Public Health,
Bureau of Sanitary Engineering
Maine:
Department of Health and Welfare,
Division of Sanitary Engineering
Massachusetts:
Department of Public Health,
Division of Sanitary Engineering

New Hampshire:
Water Pollution Commission
New York:
State Department of Health,
Water Pollution Control Board
Rhode Island:
State Department of Public Health,
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Vermont:
Water Conservation Board

New England Interstate Water Pollution Control Commission

I

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II

Part I - NEW ENGLAND DRAINAGE BASINS REPORT

Page

Introduction iii
Acknowledgments iv
Summary v
Conclusions x
Recommendations xi
General Description 1
  Historical Background 1
  Physical Characteristics 1
  Economic Development 2
Uses of Water Resources 4
Pollution Contributed to Water Resources 5
Damages to Water Resources from Pollution 7
Benefits Resulting from Pollution Prevention and Abatement 8
Pollution Prevention Measures in Effect 9
Pollution Prevention Measures Required 12

Maps

Location Map - New England Drainage Basins .... fols. xiii
Sources of Pollution .... f. 14
Existing Treatment Works .... f. 14
Project Requirements .... f. 14
Existing Primary Water Uses .... f. 14

Tables

Table 1 - Summary Data on Known Sources of Sewage Pollution viii
Table 2 - Summary Data on Known Sources of Industrial Waste Pollution ix
Table A - Sources of Pollution - Municipal 6
Table B - Sources of Pollution - Industrial 6
Table C - Existing Treatment Facilities - Municipal 9
Table D - Existing Treatment Facilities - Industrial 10
Table E - Adequacy of Existing Treatment Facilities 10
Table F - Progress in Pollution Abatement 11
Table G - Requirements for Municipal and Industrial Waste Treatment Plants 13
Table H - Status of Treatment Works Projects to Abate Pollution 15

Part II - SUB-BASIN REPORTS*

Page

South Connecticut Coastal Streams Sub-Basin (Connecticut, New York)
  General Description 16
  Pollution Data 16
  Tables 17

Housatonic River Sub-Basin (Connecticut, Massachusetts, New York)
  General Description 21
  Pollution Data 22
  Tables 23

Quinnipiac River and Coastal Streams Sub-Basin (Connecticut)
  General Description 30
  Pollution Data 30
  Tables 31

Connecticut Coastal Streams and Mystic River Sub-Basin (Connecticut)
  General Description 36
  Pollution Data 36
  Tables 37

Connecticut River Sub-Basin (Connecticut, Massachusetts, New Hampshire, Vermont; Quebec, Canada)
  General Description 40
  Pollution Data 41
  Tables 42

Thames River Sub-Basin (Connecticut, Massachusetts, Rhode Island)
  General Description 52
  Pollution Data 52
  Tables 53

Pawcatuck River Sub-Basin (Connecticut, Rhode Island)
  General Description 60
  Pollution Data 60
  Tables 61

Narragansett Bay Sub-Basin (Massachusetts, Rhode Island)
  General Description 65
  Pollution Data 65
  Tables 66

Massachusetts Coastal Streams Sub-Basin (Massachusetts)
  General Description 73

Part II - SUB-BASIN REPORTS* (cont.)

Page

Massachusetts Coastal Streams Sub-Basin
(Massachusetts)--Continued

Pollution Data 74
Tables 75

Merrimack River Sub-Basin
(Massachusetts, New Hampshire)

General Description........................ 79
Pollution Data 80
Tables........................ 81

Piscataqua and Hampton Rivers Sub-Basin
(Maine, New Hampshire)

General Description........................ 86
Pollution Data 86
Tables........................ 87

South Maine Coastal Streams Sub-Basin
(Maine)

General Description........................ 91
Pollution Data 91
Tables 92

Saco River Sub-Basin
(Maine, New Hampshire)

General Description........................ 95
Pollution Data 95
Tables 96

Presumpscot River and Casco Bay Sub-Basin
(Maine)

General Description........................ 100
Pollution Data 100
Tables 101

Androscoggin River Sub-Basin
(Maine, New Hampshire)

General Description........................ 105
Pollution Data 105
Tables 106

Page

Kennebec and Sheepscot Rivers Sub-Basin
(Maine)

General Description........................ 111
Pollution Data 111
Tables........................ 112

Penobscot River and Coastal Streams Sub-Basin
(Maine)

General Description........................ 118
Pollution Data 118
Tables........................ 119

North Maine Coastal Streams Sub-Basin
(Maine)

General Description........................ 124
Pollution Data 124
Tables........................ 125

St. Croix River Sub-Basin
(Maine)

General Description........................ 129
Pollution Data 129
Tables........................ 130

St. John River Sub-Basin
(Maine; Southeastern Canada)

General Description........................ 134
Pollution Data 134
Tables........................ 135

Lake Memphremagog Sub-Basin
(Vermont; Canada)

General Description........................ 139
Pollution Data 139
Tables........................ 140

Lake Champlain Sub-Basin
(New York, Vermont)

General Description........................ 143
Pollution Data 143
Tables........................ 144

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*Each Sub-Basin report includes Tables A through H, and "Table I - Project List - Municipalities and Industries Requiring Improvements for Abatement of Pollution."

INTRODUCTION

The Federal Water Pollution Control Act, Public Law 845, passed by the 80th Congress in June of 1948, requires the Surgeon General of the Public Health Service to cooperate with other Federal agencies, with State and interstate water pollution control agencies, and with municipalities and industries in the preparation or adoption of comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof, and improving the sanitary condition of surface and underground waters.

In developing these programs, due regard must be given to improvements necessary to conserve the Nation's waters for public water supplies, propagation of fish and aquatic life, recreational purposes, agricultural, industrial, and other legitimate uses.

Recognizing the fact that full technical information was not available to permit the development of such comprehensive programs immediately for most of the Nation's waters, the Public Health Service envisioned the development of these programs in two general phases. The first phase contemplated the development of a series of reports, consistent with presently available data, which would: provide a reference point for measuring progress; provide a guide to needed additional data; provide a basis for the logical development of comprehensive programs; provide a basis for approval of loans to States, interstate agencies and municipalities at such time as the Congress made available funds for this purpose; and serve to inform the public on the problem of water pollution and set forth suggestions for pollution control.

The collection of available data as of September, 1950, has been completed under the first phase of the program. Such data have been assembled with the cooperation of State and interstate water pollution control agencies. Through these agencies additional data have been obtained from other State officials, county and city officials and representatives of industry. Federal agencies also have been of great assistance. In order to make this information available at the earliest possible moment, these data are being presented in 15 summary-type reports covering the United States by major drainage basins. This report on the New England Drainage Basins is one of that series.

These summary reports present information about the ways our water resources are used, the pollution going into our water resources and the resulting damages, the benefits which may result from pollution prevention and abatement, the pollution prevention measures now in effect, and those required.

They are prepared in two parts. Part one considers the water pollution problems of the basin as a whole. Part two presents briefly the data for each of the several sub-basins of the major basin, including a list of projects now known to be needed for water pollution control.

Since the summary reports are based on data which are now readily available, these reports do not discuss or evaluate the most advantageous water uses as they are related to pollution control. Such considerations will be included as a part of the comprehensive water pollution control programs.

The deficiencies in data and the gaps in information indicated in these summary reports are as significant as the presentation of available facts and statistics. They indicate the work which still needs to be accomplished by water pollution control authorities for the preparation of comprehensive programs.

Data and knowledge now available are sufficient, however, to permit the immediate solution of many of the pollution problems within the New England Drainage Basins without awaiting the results of additional surveys and studies. The tabulations of pollution abatement projects which are included in Part Two of this summary report represent presently known needs. However, future studies and evaluations may result in some changes in the estimations of requirements.

A sincere effort has been made by all who contributed to this report to present a fair picture of the complex water pollution problems in the New England Drainage Basins and to present reasonable conclusions and recommendations. It is our hope that this report, as a step in the cooperative development of an ultimate comprehensive pollution control program, will help in safeguarding the water resources of the New England Drainage Basins.

Leonard A. Scheele

Surgeon General

ACKNOWLEDGMENTS

The Public Health Service wishes to acknowledge the full cooperation received in the preparation and review of this report from the following State water pollution control agencies: Connecticut (Bureau of Sanitary Engineering, State Department of Public Health, State Water Commission); Maine (Division of Sanitary Engineering, Department of Public Health and Welfare); Massachusetts (Division of Sanitary Engineering, Department of Public Health); New Hampshire (Water Pollution Commission); New York (Water Pollution Control Board, State Department of Health); Rhode Island (Bureau of Sanitary Engineering, State Department of Public Health); Vermont (Water Conservation Board), and the New England Interstate Water Pollution Control Commission. These agencies have approved this report in so far as it concerns their respective areas.

Federal agencies from which assistance was obtained include the Corps of Engineers, Department of the Army; Geological Survey, Department of the Interior; and the Bureau of the Census, Department of Commerce.

Finally, there is acknowledged the assistance of other State agencies and individuals interested in water resources development and conservation, who have contributed information through other sources than those listed above.

SUMMARY

The New England Drainage Basins are a regional area drained by a number of river basins and are comprised of the New England States and those portions of New York drained by the Housatonic and Hoosic Rivers, the Batten Kill and Lake Champlain watersheds. The total area of these regional drainage basins are 64,920 square miles.

While the Hoosic River and Batten Kill Basins are administratively a part of the New England Drainage Basins, and for the most part coexistent with the boundaries of the New England Interstate Water Pollution Control Commission compact, the data on these two tributaries of the Hudson River are not included in this report. These data were included with the parent river and are to be found in the summary report of the North Atlantic Drainage Basins.

The five largest sub-basins within the region are those of the Connecticut, Penobscot, Kennebec, Merrimack and St. John Rivers which have watersheds of 11,320; 8,570; 5,970; 5,000 and 7,200 square miles, respectively. Records of the U. S. Geological Survey, Department of the Interior, indicate that the total run-off from the New England Drainage Basins annually averages about 106,300 cubic feet per second.

New England is one of America's leading industrial areas and as a region manufacturing is well diversified. Leading products being manufactured are: machinery, textiles, fabricated metal products, leather goods, paper, hardware, brass mill products, silverware, tools, electric goods, hats, timemeasuring instruments and aircraft products.

New England residents enjoy a per capita income that is higher than the average for the country as a whole and favorably comparable with other industrial areas. The value added to products by manufacture in the basins in 1947 was estimated to be some $6,830,300,000. The total wages paid all manufacturing employees during that year was an estimated $3,948,500,000. Agriculture is the second largest source of income in the basins and the value of all farm products sold in 1945 was an estimated $560,000,000. Agricultural practices are predominantly specialized farming, with livestock products, poultry products, tobacco, fruits and truck garden produce being the leading commodities sold. Recreation is the fastest growing industry in the basins and the total expenditure within this industry in 1949 was estimated to be $870,000,000, including capital outlay for improvements, development, construction, and so forth.

The present population of the basins is estimated to be nearly 9,200,000 and represents the second most densely populated regional area in the United States. Boston, Mass., is the largest city in the basins with a reported 1950 population of 790,863.

New England makes extensive use of its water resources for all normal purposes and these are by far the region's most valuable natural asset. The original industrial development was due to the quantity, quality and availability of the water resources.

There are 790 known sources of sewage pollution discharging directly to watercourses from communities and institutions and the contributing population is over 6,600,000. Included above are an appreciable number of smaller communities not having municipal sewerage systems that contribute significant pollution from private sewers, storm drains and septic tank outlets. In some areas this type of sewage pollution poses serious problems. There are an additional 241 manufacturing plants that produce no industrial wastes but discharge the sanitary sewage from 34,300 employees directly to streams. There are several hundred other manufacturing establishments that discharge both sanitary sewage and industrial wastes. The interception of industrial wastes by public sewerage systems considerably increases the population equivalent (the number of persons whose domestic wastes would equal the amount of pollution under consideration in terms of B. O. D.) over the total of the number of persons served by sewers in many of the industrialized urban areas.

There are 1,101 separate known sources of industrial wastes discharging directly to watercourses in the basins. Of these, 885 produce organic wastes, 206 produce wastes that are principally inorganic in nature and 2 plants discharge both organic and inorganic wastes. Eight manufacturing plants are known to discharge industrial wastes but the type cannot be determined from the data available. In addition to these 1,101 sources of pollution there are 46 industrial plants suspected of discharging process wastes and for which investigations to determine their status are needed.

Organic industrial wastes originate principally in the textile, paper, leather and food processing industries. The largest amounts of inorganic industrial wastes are discharged by the fabricated metal products and brass industries.

The amount of pollution discharged to watercourses in the New England Drainage Basins in terms of population equivalent cannot be determined from the data available. Such information is on hand for 981 sources of sewage and industrial waste pollution and these have a population equivalent of 5,790,000 persons. There are 1,197 sources of pollution, mostly industrial, for which the population equivalent has not been determined. One hundred forty-two sources of organic industrial wastes pollution are known to be discharging wastes equivalent, in terms of oxygen requirement, to the domestic sewage of 1,494,500 persons.

Considering the region as a whole damages to the water resources from pollution have been extensive. Damages have been greatest to industrial process water uses and recreational uses, particularly those of bathing and game fishing. There has been very little damage by pollution of waters used as sources of public water supply, since most New England surface supplies are taken from watersheds protected from pollution.

The extensive use made of New England's water resources for all purposes and the important role these resources play in the regional economy make it obvious that there are a number of significant benefits to be gained from a comprehensive pollution prevention and abatement program.

There are 261 existing sewage treatment facilities in the basins that serve over 2,588,000 persons. The sewage from 4,082,000 persons is discharged at 785 separate sources of pollution without treatment.

Of 1,147 sources of industrial waste pollution, only 142 have been provided with treatment facilities. There are 931 known sources that discharge wastes without treatment and 74 sources for which the status of disposal has not been determined.

Only 206 of the total of 403 existing treatment facilities for all types of pollution are considered by State water pollution control agencies to be providing satisfactory treatment or disposal. One hundred fifty-two facilities for sewage treatment are satisfactory in capacity and operation, 91 are unsatisfactory and the status of 18 remains to be determined. Only 54 of the existing 142 industrial waste treatment plants are adequate while 66 are inadequate and the status of 22 others has not been determined.

The requirements for sewage and industrial waste treatment plants to abate water pollution in New England are considerable. New sewage treatment plants or disposal projects to serve 3,800,000 persons (in municipalities, institutions, industrial plants, resorts, etc.) are required to be constructed at 593 significant sources of sewage pollution. Eighty-four sources of such sewage pollution with a tributary population of 828,800 persons need enlargements or additions to existing treatment facilities, 15 require replacement of existing inadequate treatment plants serving 87,500 persons and the status and needs for treatment or disposal of sewage from 150,000 persons at 96 sources need to be determined. No project for sewage treatment is required of 228 sources of pollution having a total connected population of 1,800,000. Of these last, 152 sources are served by adequate treatment or disposal facilities and 76 are small sources of sewage pollution in Maine, New Hampshire and Vermont where dilution is considered a satisfactory means of disposal for the present or until surveys and investigations showing need for treatment have been made.

Of these 692 municipal projects for which needs are known 65 are for cities of 10,000 to 100,000 population. Forty-nine of these will serve populations ranging from 10,000 to 30,000. Two hundred and seventy-seven projects will serve populations under 2,000 and include 198 projects which will serve populations ranging from 2,000 to 10,000 with the exception of the Boston Metropolitan area which will have a population served of 1,964,000. One hundred and eighty-seven industrial plants discharging only sanitary sewage are included in the total for municipal projects. Of these latter, 159 are for factories employing under 300 persons and 28 are for factories employing from 300 to 1,500 persons.

New industrial waste treatment plants or disposal facilities are required of 671 significant sources of industrial waste pollution. Sixty-nine existing waste treatment works need enlargements or additions of other units. There are eight existing waste treatment works that require replacement with adequate treatment facilities. The treatment or disposal needs of 303 sources of industrial waste pollution need to be determined. No project is required of 96 sources of industrial waste pollution and of these 55 have satisfactory treatment plants and 41 are represented by small sources of pollution where disposal by dilution is considered satisfactory until a need for treatment is established as a result of changing water uses.

The requirements for sewage and industrial waste treatment plants to abate pollution of New England water resources total 1,440 projects of some type of construction, mostly new plants. To meet a part of these needs, formal orders to abate pollution have been issued for 23 sources of sewage pollution and 21 sources of industrial wastes pollution. Another 16 sources of sewage and eight sources of industrial waste pollution have plans for treatment or disposal facilities under preparation. The final plans for 17 sewage works and one industrial waste treatment plant have been approved. Five municipalities have advanced to the stage of awaiting means of financing before beginning construction of sewage plants. Under construction are 13 sewage and six industrial waste treatment projects.

No formal action has been taken to require treatment or disposal facilities to abate pollution at 618 sources of sewage pollution and 712 sources of industrial waste pollution representing 92.3 percent of the total determined number of projects required. The project requirements for an additional 399 known or suspected sources of pollution, mostly small, require surveys and investigations to determine treatment requirements.

While the ratio of projects required to the number that have been formally ordered (or for which plans or construction are under way) to abate pollution is small, more progress has actually been recorded. A good deal of the past pollution control in New England has been accomplished without the issuance of formal abatement orders. Through correspondence, at the request and insistence and thru the cooperation of the State water pollution control agencies, many treatment works have been constructed. In some States this has been a matter of policy and in others it has been required by lack of legislative authority to issue formal orders. Of the 1,329 sources of sewage and industrial waste pollution not shown as under orders to abate pollution, or in the planning or construction stages, probably one-fourth have been notified by official correspondence to prepare plans to abate pollution or show cause why a hearing should not be held. In the majority of cases the necessary preliminary studies have been made by the water pollution control agencies and the requirements to abate pollution are known.

Special problems in the treatment of industrial wastes have prevented good progress in the abatement of pollution by some industries in New England. In some cases the problem arises from a lack of suitable methods for treating certain wastes such as those of textile and paper mills, the leading industries in the region. In others, land sites for construction of treatment works are not readily available or are available only at great cost. The high costs of waste treatment to certain individual plants where studies have been made also are deterrents to pollution abatement. Studies by pollution control agencies and industries, preferably jointly, are needed to find reasonable and equitable solutions to such problems.

The progress in pollution abatement in New England is seriously handicapped because the majority of the States do not have adequate funds to carry out needed surveys and investigations, nor do they have sufficient personnel. In some cases employment of needed personnel is limited by appropriations and in others salary ratings are too low to attract the qualified and experienced professional groups required to carry out comprehensive pollution control programs. Unless increased funds and additional technical personnel are made available to the State water pollution control agencies a significant delay in carrying out pollution abatement program is in prospect.

The State of Rhode Island has approved plans for a treatment plant to be built jointly by the city of Newport and the large Navy establishment there for the abatement of a serious pollution problem from both of these sources. Although the city is prepared to go ahead with the work, the Navy has been unable thus far to proceed with its part of the project. Most of the New England States have adopted the policy that State institutions should provide adequate sewage treatment before municipalities and industry are required to do so. In most instances this has been done. With the Federal Government and the States joined in a cooperative program of pollution abatement, sewage treatment measures needed at government installations should be expedited wherever possible.

During the period of 1946 through June 1950 a total of 44 sewage treatment projects to serve 830,100 persons was completed. Progress in pollution abatement was also made in the field of industrial wastes. During the same period a total of 53 waste treatment projects was constructed.

At 1950 rates, the cost of construction of sewage treatment projects where the need for such facilities has been determined is estimated to be $98,850,000, excluding costs of interceptors and extensions to sewerage systems. If it is assumed that, on a regional average, the costs of intercepting sewers and sewer extensions will equal the cost of treatment plants, the total capital outlay for projects to abate pollution by sewage is estimated to be about $197,700,000. The cost of construction of industrial waste treatment projects where the need for such facilities has been determined is estimated to be approximately $52,300,000.

The total cost of all projects to abate pollution at sources where requirements are known is estimated to be $250,000,000. When the requirements for 399 other known or probable sources of pollution have been determined, the total cost of abatement projects undoubtedly will be considerably greater than shown.

A statistical summation of the foregoing narrative discussion of significant sources of sewage and industrial waste pollution follows in the tables 1 and 2. Table 1 summarizes by sub-basin the pertinent data on known sources of sewage pollution and Table 2 lists similar data on known sources of industrial wastes pollution.

All of the States in the New England Drainage Basins have adequate legislation in effect except Maine. Several of these laws are of recent enactment. In Maine the water pollution control law provides for limited licensing powers and provides for little or no control over pollution existing prior to 1945.

New York, Connecticut, Rhode Island and Massachusetts are signatory members of the New England Interstate Water Pollution Control Commission, a compact created to control and coordinate the abatement of pollution of interstate inland and tidal waters. It is expected that during 1951 Vermont and New Hampshire will join the compact and all to be eventually joined by Maine.

Table 1. Summary data on known sources of sewage pollution, New England Drainage Basins, 1950

Sub-basin	Number of significant sources of pollution	Total number of persons contributing[1]	Number of adequate treatment facilities in operation[2]	Number of known pollution abatement projects required[3]	Number of persons to be served
South Connecticut Coastal Streams......	30	318,010	12	4	211,130
Housatonic River........	75	311,159	17	50	261,751
Quinnipiac River........	11	237,265	5	10	63,290
Connecticut Coastal and Mystic River..........	12	802	3	9	527
Connecticut River.......	193	960,781	35	134	464,836
Thames River............	85	193,740	17	68	102,932
Pawcatuck River.........	22	16,463	1	11	6,093
Narragansett Bay........	77	934,739	18	48	336,683
Massachusetts Coastal..	67	2,328,360	9	19	4,107,275
Merrimack River.........	71	623,567	15	54	316,986
Piscataqua and Hampton Rivers........	35	85,250	3	32	80,300
South Maine Coastal....	14	17,180	0	14	17,130
Saco River..............	20	41,807	2	13	41,017
Presumpscot River and Casco Bay.........	22	95,500	2	15	92,960
Androscoggin River......	38	109,750	0	32	90,680
Kennebec River..........	75	100,951	3	58	97,821
Penobscot River and Coastal Streams.......	77	106,160	0	64	94,160
North Maine Coastal Streams.......	17	2,590	0	17	2,590
St. Croix River.........	7	10,630	0	4	10,400
St. John River..........	24	28,547	0	15	27,160
Lake Memphremagog.......	8	7,635	0	0[4]	--
Lake Champlain..........	71	139,360	10	19[4]	92,090

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[1] Does not include population equivalent of industrial wastes intercepted by municipal sewers.

[2] Some communities and industries have more than one treatment facility.

[3] Some communities and industries require more than one project; others are partly served by adequate facilities but require additional projects.

Table 2. Summary data on known sources of industrial waste pollution, New England Drainage Basins, 1950

Sub-basin	Number of significant sources of pollution	Number of treatment plants in operation	Number of adequate treatment plants in operation	Number of abatement projects completed, 1946 through June 1950[1]	Number of known abatement projects required[2]
South Connecticut Coastal Streams......	26	17	12	5	14
Housatonic River......	191	20	11	2	113
Quinnipiac River.......	48	19	8	1	40
Connecticut Coastal and Mystic River.....	11	3	2	0	9
Connecticut River......	243	12	5	7	159
Thames River...........	85	14	7	3	75
Pawcatuck River.........	13	1	0	0	10
Narragansett Bay........	132	22	5	14	111
Massachusetts Coastal..	31	12	2	19	27
Merrimack River........	79	12	2	2	36
Piscataqua and Hampton Rivers.......	18	0	0	0	2
South Maine Coastal....	1	0	0	0	1
Saco River............	7	1	0	0	5
Presumpscot River and Casco Bay........	10	0	0	0	8
Androscoggin River.....	20	1	0	0	15
Kennebec River.........	45	1	0	0	40
Penobscot River and Coastal Streams..	42	1	0	0	25
North Maine Coastal Streams......	10	0	0	0	10
St. Croix River.......	29	0	0	0	2
St. John River.........	32	0	0	0	26
Lake Memphremagog......	5	0	0	0	0
Lake Champlain.........	69	5	0	0	20

[1] Includes connections to municipal sewers to abate pollution.

[2] In some basins the requirements for many sources have not been determined.

CONCLUSIONS

From a consideration of the available data on which this summary report on water pollution in the New England Drainage Basins is based, it is concluded that:

1. New England is a highly industrialized, heavily populated region, geared to an economy that is mainly dependent on the welfare of the manufacturing and recreational industries, both of which are, in turn, dependent in large measure on the water resources available.

2. The water resources of New England are its most important natural resource. They are considerable in amount and number and their use for all purposes is extensive.

3. The water resources are subjected to a large amount of pollution resulting from the discharge of sewage and industrial wastes from 2,178 known separate sources of pollution.

4. Damages to the water resources from pollution have been extensive and have been greatest to industrial water supply and recreation uses which, economically, are the most important.

5. Nearly 70 percent of the known sources of pollution require the construction of new or improved treatment facilities for abating pollution and conserving the water resources. In addition to these known needs for pollution abatement those at 399 additional known or probable sources of pollution have yet to be determined.

6. The State water pollution control agencies have insufficient funds and personnel to execute comprehensive water pollution prevention and abatement programs. Neither do these agencies have adequate funds for carrying out needed studies and investigations of methods of industrial waste treatment and for gathering other necessary data to implement abatement programs. In addition funds have been insufficient for desired informational programs by which the public and industry can be apprised of the needs for and benefits of pollution prevention and abatement.

7. Some of the New England States are handicapped in proceeding with comprehensive pollution abatement programs because of industrial waste treatment problems resulting from a lack of known methods for treating certain wastes, the unavailability of land sites for construction of waste treatment plants, and the high cost of waste treatment facilities for individual industrial plants. Studies by water pollution control agencies and the industries, preferably jointly, are needed to determine the most reasonable and equitable solutions to these problems.

8. The State of Maine does not have adequate legislation to enforce a comprehensive program of pollution prevention and abatement. The other basin States have reasonably adequate water pollution control laws in effect at the present time, although improvements may be desirable in some States.

9. There are a large number of real and intangible benefits to be gained by New England through a comprehensive program of water pollution prevention and abatement which would conserve this vital natural resource for the future welfare and well-being of its citizens.

10. The original industrial development of New England was made possible by the quantity, quality and availability of its water resources. Future industrial expansion and economic welfare of the region will likewise depend in large measure on the availability and usability of these same water resources.

RECOMMENDATIONS

1. It is recommended that immediate progress in submission of plans and the construction of sewage treatment works be required, by the State water pollution control agencies, of those municipalities whose requirements are known and where methods for financing such works are adequate.

2. It is recommended that submission of plans and the construction of industrial waste treatment facilities be expedited by those industries where no further studies are needed and where reasonable and equitable methods of waste treatment are known.

3. It is recommended that as a step towards comprehensive pollution abatement that can be accomplished now, sewage pollution from private sewers, storm drains, and septic tank outlets be abated.

4. It is recommended that industries take immediate steps to provide adequate treatment of employee sewage from manufacturing plants except where studies of combined treatment of sewage and industrial wastes are indicated; and that such studies be expedited.

5. It is recommended that additional State funds be made available to water pollution control authorities so that technical staffs can be increased sufficiently to: accelerate comprehensive pollution abatement programs; conduct needed research, studies, investigations and surveys; develop and carry out sound informational programs, and promote community planning for pollution abatement.

6. It is recommended that the State of Maine enact adequate legislation to permit water pollution prevention and abatement measures to be enforced and that the authority for such enforcement be vested in one official water pollution control agency.

7. It is recommended that the States of Vermont*, New Hampshire and Maine enact the necessary legislation to permit their becoming signatory to and active members of the New England Interstate Water Pollution Control Commission Compact.

8. It is recommended that the Federal Government support State and Interstate water pollution control programs by providing adequate sewage treatment facilities for those government installations in the basins, for example the Navy installations at Newport, Rhode Island, not now meeting the pollution abatement requirements of the State agencies concerned.

9. It is recommended that all State, local, industrial and private agencies, groups or persons that are concerned with and will benefit from the conservation of the water resources of New England, cooperate closely and sincerely with the official water pollution control agencies in planning and executing comprehensive pollution prevention and abatement programs.

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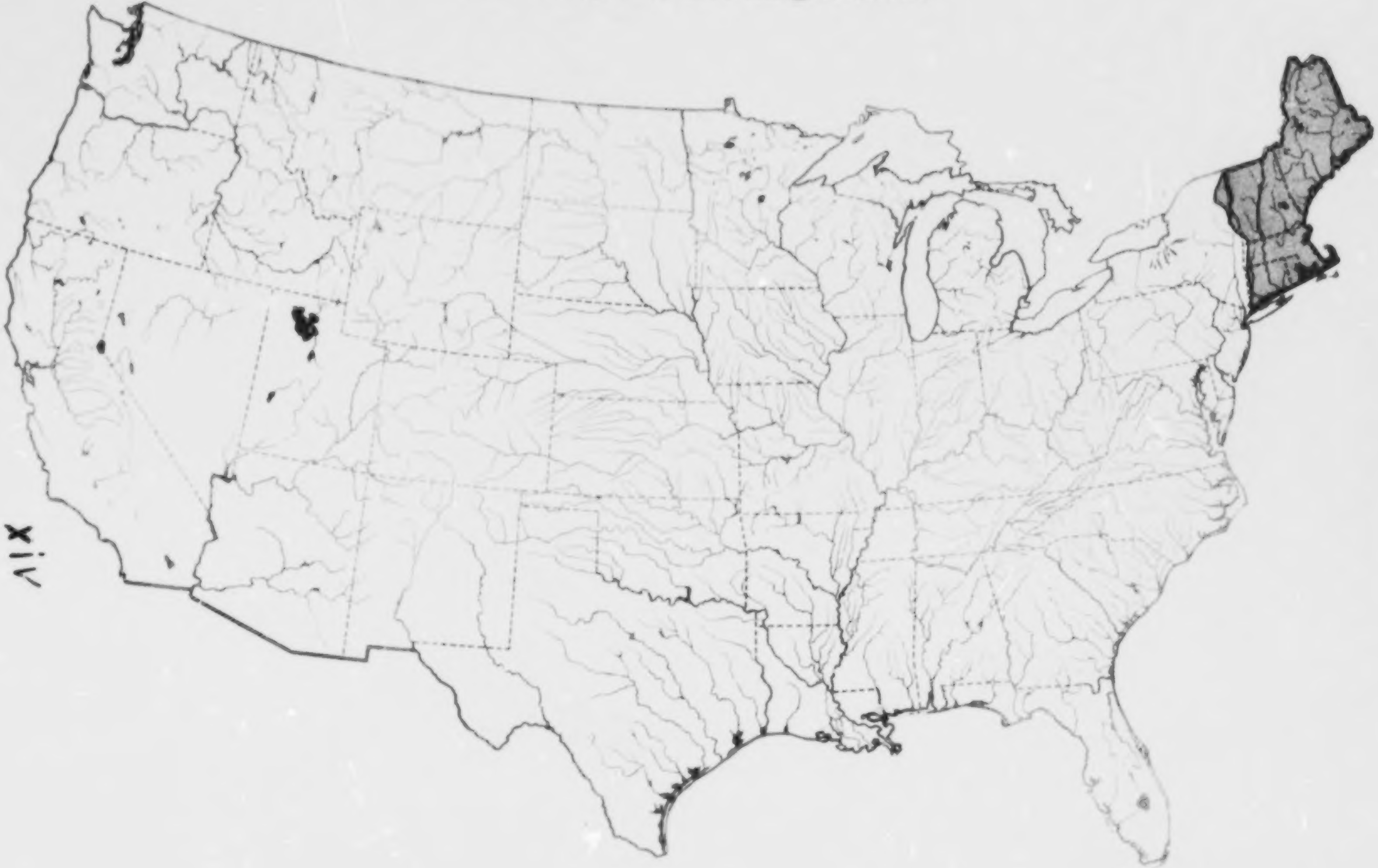
*Since the preparation of this report, Vermont has enacted the necessary legislation and now is a member of the Commission.

LOCATION MAP

New England Drainage Basins



GENERAL DESCRIPTION

Historical Background

Although Lief Ericson and other hardy Nordic adventurers are believed to have probed the shores of New England hundreds of years earlier, the first recorded history of the white man in this region begins with the landing of the Pilgrims at Plymouth Rock in 1620. The story of the struggles of the Pilgrims, and others who came later, is a tale well known throughout the Christian world. Faced with an unproductive stony soil, an unbounded wilderness and hostile Indians, the early settlers survived largely through strength gained from unwavering religious faith.

Following the Pilgrims came others, almost all in search of greater religious freedom. Religious dissension in established New World settlements resulted in segregation into further groups that set forth to establish plantations elsewhere. Such groups, joined by newcomers from England and continental Europe, eventually led to the establishment of plantations over most of New England. Some settlement of most of New England had been completed by the middle of the eighteenth century and only toward the end of the century were settlements established for material gain as well as in search of greater religious freedom.

The history of New England is so well known as scarcely to require repetition here. As the American colonies grew and expanded they were exploited by the Crown interests of England. Eventually, unable to reconcile themselves to continued taxation without representation, the colonists rebelled against England. A series of protestations followed, among which the Boston Tea Party in 1773 is probably best known. The following year the first Continental Congress assembled in Philadelphia. In 1775 the "shot that was heard 'round the world" was fired at Lexington, Mass., and the War of Independence began. When Cornwallis surrendered at Yorktown in 1781, the colonies had won their independence.

New England's population and economy grew and expanded rapidly during the period following the Revolutionary War. As the population grew the thin and depleted soil could no longer support it. Large numbers of people migrated to more fertile lands to the west. Sturdy Yankee stock had much to do with the westward expansion of the United States. Rumblings of the approaching industrial revolution had been heard in Massachusetts, Rhode Island and Connecticut even before the beginning of the political revolution for independence. By the beginning of the nineteenth century the great textile, leather, brass, hat, clock and paper industries which were to make New England famous were already flourishing. Yankee ingenuity produced numerous inventions that have contributed much to America's high standard of living. During the industrialization of New England large numbers of Europeans immigrated to this area to work in the mills. New England was a large segment of America's "melting pot", even as it is today.

New England has long been a leader in the fields of education, medicine, the arts, politics and industry. The region, with its interesting historical sites, rolling green hills, innumerable lakes and streams, has long been a favorite vacationland for all America. Most of New England's population is concentrated in urban areas and southern New England is the most densely populated and highly industrialized region in the United States.

Physical Characteristics

Geography--The New England Drainage Basins are not a watershed drained by a single river and its tributaries. They are a regional area drained by many rivers and are comprised of all the territory lying within the States of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut and the portions of New York drained by the Housatonic River, Hoosic River, Batten Kill and Lake Champlain watersheds. Several of the rivers form a part of our international boundary with Canada or drain a portion of the Dominion. These are the Lake Champlain, Lake Memphremagog, Connecticut River, St. John River and St. Croix River Sub-Basins.

The total area drained by the rivers of the New England Drainage Basins is 64,920 square miles, exclusive of the areas lying within Canada. The natural boundaries of the basins are the Hudson River Sub-Basin on the west, the Atlantic Ocean on the east and Long Island Sound on the south. The St. Lawrence River Sub-Basins and the international boundary line between the United States and Canada defines the basins to the north and east. The total watershed represents slightly less than 2.17 percent of the gross land and water area of the continental United States.

Topography--There are two principal mountain ranges in New England, the Green Mountains of Vermont and the White Mountains of New Hampshire. The southern parts of the Green Mountains range in western Massachusetts and Connecticut are more familiarly known as the Berkshire Hills. The northern portions of the White Mountains range that extend into Maine are further subdivided into the Boundary Mountains and the Blue Mountains. The highest elevation in New England is Mount Washington in the White Mountains which has an altitude of 6,288 feet above mean sea level.

In addition to the mountain ranges the land features of the basins include the rolling hills that cover most of New England and almost all of which are wooded. Interspersed between the rolling hills are literally thousands of lakes and ponds, both large and small. Probably less than 20 percent of thebasins is in cleared farmland, more than half of which is in pasture. The remainder of the basins is in woodland and very little virgin forest exists except along the northern portions of New Hampshire and Maine. Forest growths are principally second- and third-growth hardwoods except in the northern regions where the conifers predominate.

The four largest river basins principally confined to New England are those of the Connecticut, Penobscot, Kennebec and Merrimac Rivers with watersheds of 11,200; 8,570; 5,970; and 5,000 square miles, respectively. Other large watersheds that are a part of river basins common to both the United States and Canada are the St. John River and Lake Champlain Sub-Basins which have in that order drainage areas of 7,200 and 4,300 square miles within New England.

Almost all of the rivers of southern New England are important to the economic interests of the region. Principal among these smaller rivers are the Thames and Housatonic and the rivers emptying into Narragansett Bay that drain almost the entire State of Rhode Island.

The United States Geological Survey, Department of the Interior, in cooperation with State agencies and other local governmental units, maintains gaging stations in all of the principal river basins of New England. Records available indicate that the total run-off in the New England Drainage Basins annually averages about 106,300 cubic feet per second. The average annual discharge of the Connecticut River is the highest of any river in the region, being 19,250 cubic feet per second.

Geology--Granite is the predominating rock formation and is found in almost all regions of New England. There are isolated deposits of other igneous rocks, and limestone in some quantity is found in northern Maine, northern Vermont and western Massachusetts and Connecticut. Marketable quantities of marble and slate are found in western Vermont. Traprock is quarried in the Connecticut and Housatonic River valleys. Sandstone occurs in the northwestern portions of the basins and in the Connecticut Sub-Basin, and slate deposits can be found in the mountainous regions. For the most part the overburden is composed of glacial sand and gravel. The soil is generally stony and sandy and not well suited to agriculture. The most fertile soils are to be found in the lower valleys of the larger rivers and are most productive in the Connecticut and Merrimac River valleys.

Climate--Rainfall varies in New England according to distance readings are taken from the ocean, being greatest along the coastal areas and least in the northern regions. The average annual precipitation along the coastal areas varies from 40 to 48 inches. In the northern areas the average annual precipitation varies from 31 to 38 inches. Temperatures are variable but the variations are not extreme. Temperatures become lower the greater distance they are taken from the ocean. Summer temperatures near the coast average 65° to 68°F. and winter temperatures in these subbasins generally average 24° to 28°F. In the northern regions, temperatures in the summer average from 60° to 65°F. and in the winter the variations are from 14° to 20°F.

Natural Resources--New England has but three natural resources of consequence at the present time--forests, land and water. Numerous minerals are to be found in the region but none is present in economically recoverable amounts. There are commercial deposits of marble, granite, traprock and limestone and these rocks are being quarried but their importance to the economic structure of the region is small. The land resources are below average in fertility and could not begin to support the population. Very little virgin forest remains and lumbering is generally for the pulpwood industry. Some hardwoods are used in the manufacture of furniture and kindred products. The water resources of New England are its most valuable natural asset. Water was the resource on which the great New England industries developed, on which these industries are largely dependent today, and on which the future economy of the region will depend in considerable measure.

Economic Development

The first economy in New England was necessarily agricultural. The first problems of the early settlers were to feed and clothe themselves. Clothing and footwear were largely made in the home. New England was dependent on other lands for manufactured goods, and shipbuilding and trading early became leading industries. By the latter part of the seventeenth century shipbuilding was the major industry along all of the tidal rivers from the Housatonic in Connecticut to the Kennebec in Maine. Yankee-built schooners, manned by farmer-sailors, were to be seen in all the principal ports of the world, trading oak staves, hides, farm produce and other products of the land for the manufactured goods and luxuries of other lands.

As the population increased, the farms were tilled with increasing intensity and by the middle of the eighteenth century the depleted soil could no longer support the people. Large numbers moved on to more fertile lands west of New England and those who remained were forced to find new ways of earning a livelihood. Whether by choice or by necessity, the Yankee soon turned to manufacturing as a means of income.

The first gropings toward an industrial economy were largely in home manufacture of goods to supply local markets. When local markets were saturated the manufacturer piled his wares on his back and set forth to more distant consumers. As the demand for more goods was established the manufacturer increased production and hired others to peddle his wares. Thus were established the "Yankee peddlers" who were a nineteenth century American institution. The first manufactured products were tinware, brass goods, combs, buttons, wooden clocks, hats and leather goods.

Water power was harnessed for use in grist mills near the middle of the seventeenth century, but was not widely used in manufacturing until the latter part of the century. With the development of water power the manufacturing output increased rapidly and New England became a leading manufacturing center. The wars of our history were stimuli to the industries and during, and for a period after each war, manufacturing expanded greatly. Several "centers" of the industrial world were established in New England before 1850. The region led in the production of hats, brass mill products, hardware, paper, clocks leather products and textile mill products. New England still leads the country in the production of many of these products and in recent years has added to the list a large production of silverware, machinery, electrical goods, tools, fabricated metal products, metal jewelry, measuring and recording instruments, and aircraft products.

New England has been geared to a manufacturing economy for more than a hundred years and is one of America's leading industrial regions. In 1947 there were more than 20,300 manufacturing establishments in the New England Drainage Basins, which employed an average of about 1,477,700 employees during the year. The salaries and wages paid all manufacturing employees during that period was approximately $3,948,500,000 and the value added to products by manufacture was an estimated $6,830,300,000.

Farming is principally specialized in support of the nearby urban communities. Dairying, poultry raising, tobacco farming, and truck gardening are the principal agricultural activities. The total revenue from all farm products sold in 1945 was approximately $560,000,000, less than one-sixth of the income earned by manufacturing employees. The recreational industry has become increasingly important to the economy of the northern residents of the basins and the total monies spent for all recreational purposes, including improvements, was an estimated $870,000,000 in 1949. The self-employed, those engaged in the service industries, and in the professional fields probably add another $1,000,000,000 to the income of the basins.

The 1950 population of the basins is estimated to be 9,200,000 and represents the second most densely populated region in the United States. Boston, Mass., is the largest city in the basins with a reported 1950 population of 790,863.

It appears that New England should continue to be a leading industrial region. It has a most valuable asset for the future in its water resources. The years have built up a vast reservoir of skilled labor. Transportation facilities are for the most part excellent. Nature has endowed New England with a natural beauty and outdoor recreational opportunities that should not only result in a continued expansion of the recreation industry but make it a most desirable place in which to live, attractive to both industry and labor force. New England's water resources have contributed most to its growth, development and attractiveness. If New England's economy is to continue to expand, the water resources must be conserved for future maximum use.

USES OF WATER RESOURCES

New England has long made important use of its water resources and today there is an extensive use of the water resources for every normal purpose. There is widespread use for public water supply, industrial water supply, livestock watering, game fishing, recreational bathing, boating, wildlife habitat, commercial fishing, shellfish operations, navigation, transportation of logs, transportation of wastes, hydroelectric power development and even irrigation is becoming an important use in Massachusetts and Connecticut.

Practically every one of these uses is of vital importance to the economy of some region in the basins. Public water supply is the most widespread important use of the water resources. The vast majority of the residents of the basins are served by surface water supplies. Public water supplies of small communities in many parts of the basins are frequently developed from ground water resources. A large proportion of New England manufacturing is in the so-called "wet process" industries, and use of the water resources for industrial water supply is of great importance to the economy of the region, particularly in the highly industrialized urban areas in the southern parts of the basins. The recreational industry is growing steadily in New England and use of the water resources for all types of recreation and for wildlife habitats is becoming increasingly important, not only to those who derive pleasure from these uses, but to the general economy of the basins as well.

Agriculture is the second largest source of income in the basins, and use of the water resources for agricultural purposes is of considerable importance.

The shellfish industry is dependent on the water resources and not only provides employment and income for a large group of people but also is one of New England's leading tourist attractions. The lumbering operations in the northern parts of the basins in New Hampshire and Maine would be almost impossible to carry out without water transportation. There has been a very widespread use of the water resources for transportation of wastes which has, in many areas, resulted in serious water pollution to the detriment of other normal water uses.

For a considerable number of years New England's welfare has been closely associated with her water resources and every indication is that this relationship will continue.

POLLUTION CONTRIBUTED TO WATER RESOURCES

Sources of Municipal Pollution

There are 790 separate sources of sewage pollution from communities in the New England Drainage Basins. The number of persons contributing to these sources of sewage pollution is over 6, 600, 000, of which more than 90 percent live in urban areas. Of the total of 790 sources of domestic sewage pollution a little more than 100 are represented by small communities without public sewerage systems, and by schools or institutions, very few of which have a contributing population of over 500.

The discharge of employee sewage from manufacturing plants is a substantial source of stream pollution, particularly in areas lying outside urban communities in Connecticut and Massachusetts. There are, in addition to the above mentioned 790 sources of sewage pollution, 241 manufacturing establishments that produce no industrial wastes, but are known to discharge the sanitary sewage from 34, 300 employees. Probably three times that amount of sewage pollution is discharged by other industries that also discharge industrial process wastes. It is estimated that industry daily discharges directly to watercourses the sanitary sewage from more than 150, 000 employees.

Table A, which follows, summarizes the data on sources of municipal pollution. It will be noted that the majority of sources of sewage pollution have data on the pollution load discharged to watercourses. The 839 sources for which this information is available, have a total population equivalent 50 percent greater than the number of persons served. This increase is almost wholly due to the combined sewage and industrial wastes from the Lawrence-Lowell-Haverhill area, which includes large volumes of wool scouring and other textile processing wastes. These cities have a total connected sewerage population of 250, 000, but the population equivalent of the combined sewage and industrial wastes is 1, 300, 000.

There are 192 sources of sewage pollution, the population equivalent of which is unknown. This is largely because the strength of included industrial wastes has not been determined. The population served by these sewerage systems is slightly over 3, 800, 000, but the actual population equivalent of the sewage flow is probably at least 20 percent higher.

Sources of Industrial Pollution

There are 1, 101 known sources of industrial wastes discharging to the watercourses of the New England Drainage Basins and 46 others may be discharging pollution, but the types and disposition of wastes, if any, have not been determined. There are 885 manufacturing establishments that produce process wastes of an organic nature, 206 that produce inorganic wastes, and 2 plants produce both organic and inorganic wastes. The type of wastes produced by eight known sources of pollution cannot be determined from the data available.

The amount of pollution discharged by 142 plants producing organic wastes has been determined to have a population equivalent of 1, 494, 000. There is not sufficient information to determine the amount of pollution discharged by another 745 plants producing organic wastes nor even to make a reasonable estimate. The wastes from 208 sources of inorganic pollution are not amenable to computation in ordinary terms of pollution measurement.

The processing of textile mill products, which includes wool scouring and hat manufacturing, produces the largest volume of organic waste pollution in the basins. Other large volumes of organic wastes are discharged by the paper and allied products industries and by food processing plants. Organic wastes are also discharged by plants engaged in the manufacture of products from wood, coal, petroleum, rubber and leather and by plants manufacturing chemicals.

Large amounts of inorganic pollution are discharged by the fabricated metal products manufacturing plants in the form of acid pickling wastes, machine and cutting oils, metals in a large variety from electroplating and cyanides. The brass mills discharge huge volumes of wastes carrying acids and dissolved metals. Other inorganic wastes of consequence originate from optical lens grinding, sand and gravel washing, and the manufacture of agricultural lime.

Table B, which follows, summarizes the sources of industrial waste pollution.

Table A. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people) **
Having data on pollution load discharged to watercourse	839[1]	2,856,089	4,295,668
Having population data available (Data on pollution load to watercourse incomplete or not available)	192[2]	3,815,017	Not applicable
Total	1,031	6,671,106	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] Includes 229 industries having sanitary sewage only from 33,387 employees.

[2] Includes 12 industries having sanitary sewage only from 951 employees.

Table B. Sources of pollution, industrial

Industries *	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	142[1]	1,494,556
Producing organic wastes	745	Undetermined
Producing inorganic wastes	208	Not applicable
Producing wastes of undetermined type	54[2]	Undetermined
Total	1,147[3]	--

*Industries having separate outlets and discharging wastes, directly to watercourse.

[1] Includes 2 plants also producing inorganic wastes.

[2] The type and disposition of wastes, if any, for 46 industries is unknown.

[3] Total adjusted to correct for duplication noted in above footnotes.

DAMAGES TO WATER RESOURCES FROM POLLUTION

Considering the New England Drainage Basins as a whole, it is concluded that damages to the water resources have been extensive. At some point or other in the basins every normal downstream water use has been damaged by pollution except power development and transportation of logs. Damages have been greatest in the southern portions of the basins where populations and industries are more concentrated.

There has been only small damage to public water supplies, because sources are almost all taken from watersheds protected from pollution or from wells not subject to pollution. Further, all of the public water supplies are closely supervised by State health departments. In some areas it may be desirable to develop future public water supplies at some distance from the points of distribution because of the pollution of closer sources. This practice may be safer and more economical than treatment of the polluted waters nearby.

Large volumes of stream water have been made unsuitable for industrial water supply by pollution, and the vast majority of manufacturers requiring water have been forced to install expensive water treatment equipment.

There has been extensive damage to the recreational use of the water resources throughout the basins, principally to uses for recreational bathing and game fishing. Large shore areas have been closed to the taking of shellfish and bathing. An appreciable number of the smaller streams have been damaged for use in livestock watering and other agricultural uses.

Long stretches of the principal tributaries of several of the main rivers, and even portions of the main stems, transport such volumes of pollution as to be suitable for this purpose only, and during critical periods of low flow and high temperature nuisance conditions sometimes are created. Such conditions are found in the Connecticut, Merrimack, Thames, Housatonic, Androscoggin, St. John, and Penobscot River Basins and in the Narragansett Bay Drainage Basin. Similar damages from pollution have been caused in some of the more important small river basins, such as the Quinnipiac, Charles, Neponset, Pawcatuck and Piscataqua River Basins.

In the northern parts of the New England Basins damage has been greatest to the water resources for recreational use--one of their most important economic uses. Damages to these uses have been mainly from the discharge of domestic sewage. Even greater damages have been sustained in Vermont and New Hampshire on important tributaries to the Connecticut River by the discharge of untreated milk processing and paper mill wastes. The principal source of pollution in northern Maine is domestic sewage, except in the Androscoggin, St. John, Aroostook, and upper Penobscot River where serious pollution results from the discharge of pulp and paper mill wastes. The St. John and Aroostook Rivers also transport large volumes of starch plant wastes.

In Massachusetts, Rhode Island and Connecticut, damages are caused by the discharge of large volumes of organic and inorganic industrial wastes and domestic sewage. Very little of the principal waters escape any damage, and below urban areas of concentrated population and industry the damages are serious. Industrial wastes also cause serious damage to some of the streams and rivers in rural areas.

New England makes most extensive use of the water resources for industrial purposes and transportation of sewage and wastes. This has resulted in appreciable damage to large volumes of water for their normal and desired uses.

BENEFITS RESULTING FROM POLLUTION PREVENTION AND ABATEMENT

From information available and the studied considerations of water pollution control agencies, development authorities, conservation groups and health interests, there are at least 12 significant benefits that could result from a comprehensive program of pollution prevention and abatement in New England. These significant benefits are, in brief, as follows:

1. There will be a real benefit to the public health by the treatment of and elimination of sources of municipal, institutional, and industrial sewage by reducing the chances of waterborne diseases.
2. Large volumes of readily accessible waters at desirable industrial sites will be made suitable for and attractive to new industries, resulting in increased income and economic stability in New England.
3. Manufacturing plants now dependent on damaged water resources for process waters will realize a substantial savings in present costs of water treatment.
4. Many industries discharging industrial wastes will realize substantial savings through recovery of valuable by-products and greater utilization of raw materials.
5. Water resources in and near the urban centers of population will be made suitable for recreational development. Residents will benefit from greater opportunities to enjoy outdoor recreation and will save appreciably on travel costs by having these facilities nearby.
6. Industrial, residential and recreational real estate located on or dependent on presently polluted watercourses will be made more desirable and will be considerably increased in value when pollution is abated.
7. Pollution abatement will make large areas of land and water resources suitable for development by the recreation industry, thereby adding to the income and economic stability of the region by an increased tourist and vacation trade.
8. Aesthetic nuisances created during critical periods of low flow and high temperature will be eliminated.
9. Large areas along the coastline will again be made suitable for the propagation and harvesting of shellfish.
10. Residents of the basins will benefit from an increased enjoyment of the natural beauty of clean streams and improved appearance of the area in general. Probably more important, visitors to the river basins will be similarly impressed and the general reputation of the areas and the residents thereby enhanced.
11. Considerable savings will be realized in real estate maintenance after elimination of paint destruction by hydrogen sulfide originating in nearby polluted waters.
12. The general welfare of the people will be further enhanced by the conservation of a vital natural resource and by a greater opportunity to benefit from its use.

POLLUTION PREVENTION MEASURES IN EFFECT

Existing Municipal and Industrial Treatment Facilities

Data on existing treatment facilities are given in Tables C and D, which follow, and these require very little discussion.

It can readily be computed from Table C that the sewage from 21.5 percent of the contributing population receives primary treatment and the sewage from 17.2 percent receives secondary treatment; thus a total of 38.7 percent of the sewage from the total contributing population is receiving treatment. The sewage from some 4,085,000 persons, or 61.3 percent of the contributing population, is discharged to watercourses without treatment.

On the basis of total number of sources of sewage pollution, 11.5 percent have been provided with primary treatment facilities, 12.2 percent have been provided with secondary treatment plants, and 76.3 percent have not been provided with treatment facilities. If the sources of sewage pollution from manufacturing plants are disregarded, it will be seen that 27.6 percent of the municipal and institutional sewage pollution receives treatment while 72.4 percent discharges sewage without treatment.

There is a total of 1,147 separate sources of industrial waste pollution in the Basins, as shown in Table D, which also shows the type of industry producing these wastes. One hundred forty-two sources of waste pollution, or 12.4 percent of the total, have been provided with treatment facilities; 81.1 percent or 931, are known to discharge to watercourses without treatment, and there are 74 sources or 6.5 percent, where it has not been determined whether or not treatment facilities exist.

Of a grand total of 2,178 separate sources of sewage and industrial waste pollution, only 392, or 18 percent, have been provided with treatment facilities.

Adequacy of Existing Treatment Facilities

The adequacy of existing treatment facilities is shown in Table E. Of the existing sewage treatment plants, 58.2 percent are providing a satisfactory degree of treatment, 34.9 percent are unsatisfactory because units are overloaded, and the adequacy of 6.9 percent of the sewage treatment plants has not been determined. It will be noted that 44 of the 196 sewage treatment facilities being operated satisfactorily are inadequate by reason of exceeded capacities.

Only 54, or 38.0 percent, of the industrial waste treatment facilities are completely satisfactory, 46.5 percent are inadequate in capacity, and the status of 22 existing treatment plants has not been determined.

Progress in Pollution Abatement

During the postwar period of 1946 through June 1950 a total of 44 projects for the treatment of sewage was completed. These projects were designed to serve a contributing population of 830,100 persons. During this same period a total of 53 projects for the treatment and disposal of industrial wastes were constructed but the data on amounts of waste treated are not available.

Table C.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	124[1,2,3]	131	1,441,921
Secondary	126[4,5]	130	1,146,862
No treatment	785[1,6]	0	4,082,323

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourses.

[1] Four municipalities provide primary treatment for some sewage and no treatment for remainder and are listed twice.

[2] Includes 26 industries having sanitary sewage only from 4,402 employees.

[3] One municipality is served by seven treatment plants. Four municipalities are served by two treatment plants each. One municipality's sewage is treated by another community. Two housing developments are served by one treatment plant. Two municipalities are served by the South Essex Sewerage District treatment plant.

[4] Includes 7 industries discharging only sanitary sewage, from 730 employees.

[5] One industry discharging only sanitary sewage has four treatment plants. One municipality is served by two treatment plants.

[6] Includes 208 industries discharging only sanitary sewage, from 29,206 employees.

Table D. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products..	225	18	203	4
Textile mill products......	376	32	333	11
Lumber and wood products...	24	0	24	0
Paper and allied products..	132	18	112	2
Chemical and allied products.................	40	10	24	6
Products of petroleum and coal...................	11	5	6	0
Rubber products............	16	0	12	4
Leather and leather products.................	35	11	24	0
Primary metal industries...	27	6	20	1
Fabricated metal products..	188	25	120	43
Miscellaneous..............	73	17	53	3
Totals.................	1,147	142	931	74

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satis-factory	Unsatis-factory	Unde-termined	Satis-factory	Unsatis-factory	Unde-termined
Municipal	251	152	91	18	196	37	28
Industrial	142	54	66	22	86	32	24

Table F shows progress in pollution abatement in terms of completed projects during the period 1946 through June 1950.

Special problems in the treatment of industrial wastes have prevented good progress in the abatement of pollution by some industries in New England. In some cases these problems arise from a lack of suitable methods for treating certain wastes such as textile and paper mill wastes, the leading industries in the region. In others, land sites for construction of treatment works are not readily available or are available at great cost. The high costs of waste treatment to certain individual plants where studies have been made are also deterrents to pollution abatement. More studies are needed by pollution control agencies and industries, preferably jointly, to find reasonable and equitable solutions to such problems.

The progress in pollution abatement is seriously handicapped by lack of funds and personnel available in water pollution control agencies. The majority of the States do not provide adequate funds to carry out needed surveys, investigations and research nor do they have sufficient personnel for such work. In some cases employment of personnel is limited by appropriations and in others salary ratings are too low to attract the qualified and experienced professional groups required to carry out comprehensive pollution control programs. Unless increased funds and larger technical staffs are made available to the State water pollution control agencies, a significant delay in carrying out pollution abatement programs is in prospect.

Relatively slow progress in pollution control in several of the States has been due in part to inadequate legislation. Until very recently the majority of the States did not have adequate legislation to enforce construction of needed treatment works. Except in cases of public nuisances pollution control was affected only with the consent and cooperation of the polluter. In the face of rising costs, municipalities and industries were reluctant to spend monies for treatment works.

Progress in one important pollution abatement project in Rhode Island has been delayed through inability of the Navy to proceed with its part of the project. A large Navy installation at Newport and the city of Newport have State approved plans for the combined treat-

Table F. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	3	4,700	5	Unavailable
1947	5	47,800	5	Do
1948	3	28,900	12	Do
1949	15	206,600	19	Do
To July 1950	18	542,100	12	Do

ment of sewage from these two sources. The city is ready to go ahead with the work, whenever the Navy can proceed. Most of the New England States have adopted the policy that State institutions should provide satisfactory treatment of sewage before municipalities and industry are required to do likewise. In most instances this has been done. With the Federal Government and the States joined in a cooperative program of pollution abatement, the Federal agencies should expedite sewage treatment measures needed at government installations wherever possible.

Legislation in Effect

With the exception of Maine, all of the States in the New England Drainage Basins have reasonably adequate water pollution control laws in effect at the present time, although improvements may be desirable for some states. The majority of these laws are of recent enactment or have been effectively amended since 1944. The Maine Sanitary Water Board Law was enacted in 1941 and amended in 1945 and 1946. This law is inadequate to enforce pollution abatement, as its principal authority is to license or deny licenses to sources of pollution created since 1943. The Board has little or no control over sources of pollution existing prior to that date.

The States of Massachusetts, Connecticut, Rhode Island and New York are signatory members of the New England Interstate Water Pollution Control Commission, a compact created to control and coordinate the abatement of pollution of interstate inland and tidal waters of New England. The Commission consists of five commissioners from each of the signatory States and, to advise it on technical matters, has a Secretary who is a qualified sanitary engineer. In addition there is an Advisory Board comprised of the heads of the technical divisions of the water pollution control agencies of each of the signatory States.

The States of Maine, New Hampshire and Vermont are not as yet members of the New England Interstate Water Pollution Control Commission. It is expected that the necessary legislation will be passed to permit Vermont* and New Hampshire to join the compact early in 1951. Maine is expected to join in the compact, but the necessary legislation may not be forthcoming in 1951.

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*Since the preparation of the report, Vermont has enacted the necessary legislation and now is a member of the Commission.

POLLUTION PREVENTION MEASURES REQUIRED

One of the principal requirements to prevent and abate stream pollution in New England is funds for use by the water pollution control agencies in the development and execution of comprehensive programs. All of these agencies have inadequate personnel and funds for conducting needed surveys and investigations. Several of the agencies are charged with other responsibilities than water pollution control and this causes further inroads on limited personnel. Several are also dependent on other agencies for certain personnel and services, and these other agencies are also understaffed and charged with many additional responsibilities. Unless the water pollution control agencies are provided with needed funds, the only prospect for pollution control in New England is that of a long-term abatement program from which the accruement of benefits will seldom be sufficiently apparent to win the support of the citizens, industry, and other groups interested in conservation of water resources.

The general public and industry in New England have not given sympathetic support to water pollution control programs. This has come about in large measure because the water pollution control agencies have not had sufficient funds for information programs which would give the public and industry an understanding of the needs for and benefits to be derived from pollution abatement. These agencies also need funds for the guidance of community planning of pollution control projects so that the maximum benefits will be achieved and the best interests of the majority will be served by water pollution prevention and abatement.

In Maine a serious deterrent to water pollution control is a divided legislative authority among several State agencies in water pollution control. Various chapters of the Maine laws authorize certain powers to the Department of Health and Welfare, the Sanitary Water Board, the Department of Public Utilities, and the Department of Sea and Shore Fisheries in the control of water pollution. The control of nuisances created by water pollution is under the jurisdiction of the courts and not the public health authorities. The present water pollution control law is actually a limited licensing law and its only enforcement feature is the authority granted the Sanitary Water Board to issue or deny licenses to discharge pollution from sources established since 1945. Sources of pollution existing prior to 1945 may continue to pollute watercourses. Before water pollution can be satisfactorily controlled in Maine, adequate legislation must be provided.

Requirements for Municipal and Industrial Waste Treatment Plants

There are 228 sources of sewage pollution and 96 sources of industrial waste pollution for which no projects are required. The majority of these are already provided with adequate treatment facilities and the remainder are small sources of pollution in New Hampshire, Vermont and Maine where dilution is considered a satisfactory method of disposal for the present until water quality requirements indicate the need for treatment.

It was shown previously by Tables A and B that there are a total of 2, 178 sources of pollution, 1, 031 discharging sewage and 1, 147 discharging industrial wastes. Table G will show that 1, 440 sources, or 67 percent of the total of all sources, are known to require some type of construction to abate pollution. Of these requiring sewage treatment projects, 593 sources require construction of new plants to serve 3, 800, 000 persons, 84 need enlargements or additions to existing inadequate plants serving some 828, 000 persons, and 15 require replacement of existing plants satisfactorily to serve a connected population of 87, 000. Of these 692 municipal projects for which needs are known, 65 are for cities of 10, 000 to 100, 000 population. Forty-nine of these will serve populations ranging from 10, 000 to 30, 000. Two hundred and seventy-seven projects will serve populations under 2, 000 and include 198 projects which will serve populations ranging from 2, 000 to 10, 000 with the exception of the Boston metropolitan area which will have a population served of 1, 964, 000. One hundred and eighty-seven industrial plants discharging only sanitary sewage are included in the total for municipal projects. Of these latter, 159 are for factories employing under 300 persons and 28 are for factories employing from 300 to 1, 500 persons.

There are 671 sources of industrial waste pollution that require construction of new treatment plants and eight others also require new plants to replace inadequate existing treatment facilities. Sixty-nine sources of industrial wastes pollution need additions or enlargements to existing works before treatment will be satisfactory.

The requirements for 399 sources of pollu-

tion, many of them small, have not been determined, and studies and investigations of these are required.

Table G. Requirements for municipal and industrial waste treatment plants*

Requirements **	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	593[1]	3,800,640	671
Enlargement or additions to existing plant	84[2]	828,784	69[6]
Replace existing plant	15[3]	87,455	8[7]
No project required	228[4,5]	1,803,435	96[8]
Undetermined	96	150,790	303

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**For a listing of individual project needs refer to Table I included at the end of each sub-basin discussion following the main part of this report.

[1] Includes one municipality requiring a new plant to serve part of the city and replacement of an old plant now serving another part of the city. Also listed under "Replace existing plant".

Includes one municipality requiring a new plant to treat sewage now discharged to river untreated. Municipality has a satisfactory plant serving part of city and is also listed under "No project required".

Includes Metropolitan District Commission (Boston area) serving 33 communities and requiring only 3 projects to abate pollution. The Boston Main Drainage System is included.

Includes one municipality that requires a new treatment plant to serve part of the city. Also listed twice under "No project required" since the city has two satisfactory sewage treatment plants in operation.

[2] Includes two industries having sanitary sewage only that is treated unsatisfactorily in 5 existing plants.

Includes one municipality with satisfactory treatment for present loading but requires enlargement of plant to provide for additional load from sewers now under construction.

Includes one treatment plant of satisfactory design and operation that requires enlargement to improve treatment for present loading.

One industry with sanitary sewage only and four municipalities, all with treatment plants of undetermined design and operation, that are known to require additions.

One treatment plant of satisfactory design and operation requires an extension of plant outfall into deeper water for adequate disposal of effluent.

Includes two treatment plants serving one municipality.

Includes one municipality requiring extension of intercepters to convey sewage now discharged to river to existing adequate sewage treatment plant. Also recorded under "No project required".

[3] Two unsatisfactory treatment plants must be replaced by one municipality.

[4] Sewage from one municipality is treated in plant owned by another municipality.

[5] Includes two municipalities each having two treatment plants, which are satisfactory.

Includes 19 small municipalities that will abate pollution by requiring adequate private disposal by responsible individuals.

Includes one adequate treatment plant serving two Federal Housing Administration projects.

Includes 7 municipalities disposing of their sewage by dilution to tidal waters. At present satisfactory to state water pollution control agencies.

Includes one municipality with unsatisfactory private sewage treatment where pollution will be abated by adequate private disposal.

Includes the South Essex Sewerage District serving two municipalities.

Two hotels and 47 municipalities and industries with sanitary sewage only, dispose of their sewage by dilution, satisfactory to state water pollution agency for present.

Three municipalities with treatment plants of undetermined design and operation, do not require projects.

Includes 7 treatment plants serving one municipality.

[6] Eight treatment plants whose adequacy of design and operation are undertermined and require additions.

[7] Three treatment plants, whose adequacy of design and operation are undetermined, require replacement.

[8] Forty-one industrial wastes disposed of by dilution, satisfactory for the present.

One treatment plant, with undetermined design and operation, requires no project.

Analysis of Costs of Required Municipal and Industrial Waste Treatment Plants

The total cost of construction of the presently known required municipal and industrial waste treatment plants shown in Table G above, and listed individually in Table I of the various sub-basin reports that follow, (exclusive of the costs of intercepting sewers) is estimated to be $151, 150, 000. Of this total, $98, 850, 000 is the estimated cost of construction of sewage treatment plants and $52, 300, 000 is estimated for the construction costs of industrial waste treatment plants.

The costs of construction of sewage treatment plants are based on data furnished by water pollution control agencies and cost analysis data available in professional engineering publications and have been adjusted to construction cost indexes for July 1950. The costs of construction of industrial waste treatment plants were based on an estimated average of $75, 000 per new individual plant and $5, 000 average for plants requiring enlargements or additions. This figure was arrived at from the estimate of several consulting engineers and water pollution control authorities. Some of the projects required will involve an expenditure of only a few hundred dollars for connection to public sewers and others will involve costs of several hundred thousand dollars for large waste treatment plants.

There are no data available on which to base a reasonable cost for construction of intercepting sewers. The lengths and sizes of intercepting sewers required have not been determined, borings have not been made, the number of sewage pumping stations required is unknown and in some cities existing trunk sewers may serve as intercepters. Some local consulting engineers feel that it is unwise to estimate the costs of intercepters with the meager information at hand on the basis that the figure may be considerably in error and thus misleading if used. Other local engineers, also with wide experience in New England, feel that considering the large number of projects of varying size and dispersed over a wide area the cost of intercepters on the average will very nearly approximate the cost of sewage treatment plant facilities. If one adheres to the latter school of thought, the cost of intercepting sewers for projects required in New England as shown by Table G would be approximately $98, 850, 000.

The estimated cost of sewage and industrial waste treatment for present projects now known to be required in New England is totaled below.

Sewage treatment plants	$98, 850, 000
Intercepting sewers.	98, 850, 000
Industrial waste treatment plants.	52, 300, 000
Total	250, 000, 000

Recognizing that these expenditures will take place over a number of years, the estimated costs will be increased due to added factors. These include additional annual obsolescence and rehabilitation requirements, needs of communities installing new sewerage systems, normal population increases and industrial expansion, as well as allowance for presently undetermined needs.

There are 96 sources of sewage pollution and 303 sources of industrial waste pollution for which treatment requirements have not been determined and construction costs for which are not included above. Many of these projects will be small when requirements are determined but nonetheless will add several million dollars to the above totals.

Status of Treatment Works Projects to Abate Pollution

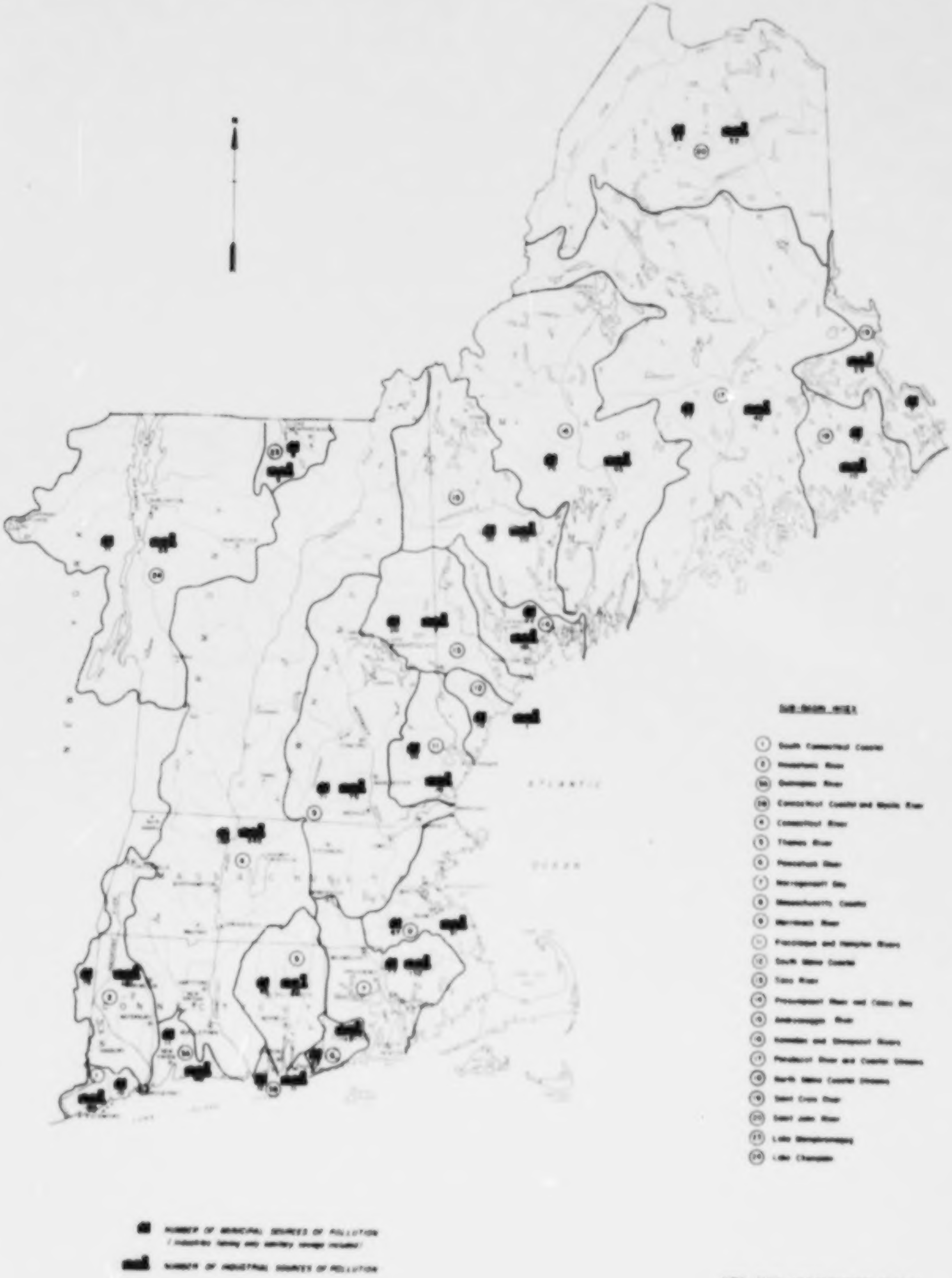
The status of treatment works projects to abate pollution are summarized in Table H.

Of the total of 1, 440 projects required for construction of sewage and industrial waste treatment plants, there has been no formal action taken to have treatment facilities provided at 1, 330 sources or 92. 5 percent of the total number. The remaining 7. 5 percent have been ordered to abate pollution or are in the process of providing required treatment works.

In addition to the 1, 440 required projects, there are 399 other sources of pollution that require determination of stream classifications and/or project needs before steps can be taken to provide treatment facilities.

The above figures on status of treatment works projects, however, are somewhat misleading. A good deal of the construction of treatment works in New England is accomplished without the need for issuance of formal orders to abate pollution. Most of the States now have authority to issue formal abatement orders, a fact known to the violators. Through the requests, insistence, and cooperation of the water pollution control agencies by ordinary correspondence, and sometimes by the holding of formal hearings to show cause why orders should not be issued, violators proceed to provide the required pollution abatement works. This procedure is followed by the majority of the States as a matter of program procedure and policy.

Table H will show that no formal action has been taken to abate pollution at 618 sewage and 712 industrial waste sources of pollution. In addition to the action that is shown in the table, probably one-fourth of those on which no formal action has been taken have been notified to take steps to abate pollution or hearings for this purpose have been held. The require-


ATLANTIC
OCEAN
SUB-BASIN INDEX
South Connecticut Coastal
Housatonic River
Quinnipiac River
Connecticut Coastal and Mystic River
Connecticut River
Thames River
Pawcatuck River
Narragansett Bay
Massachusetts Coastal
Merrimack River
Piscataqua and Hampton Rivers
South Maine Coastal
Saco River
Presumpscot River and Casco Bay
Androscoggin River
Kennebec and Sheepscot Rivers
Penobscot River and Coastal Streams
North Maine Coastal Streams
Saint Croix River
Saint John River
Lake Memphremagog
Lake Champlain
NUMBER OF MUNICIPAL SOURCES OF POLLUTION
(Industries having only sanitary sewage included)
NUMBER OF INDUSTRIAL SOURCES OF POLLUTION
SCALE OF MILES

15-a

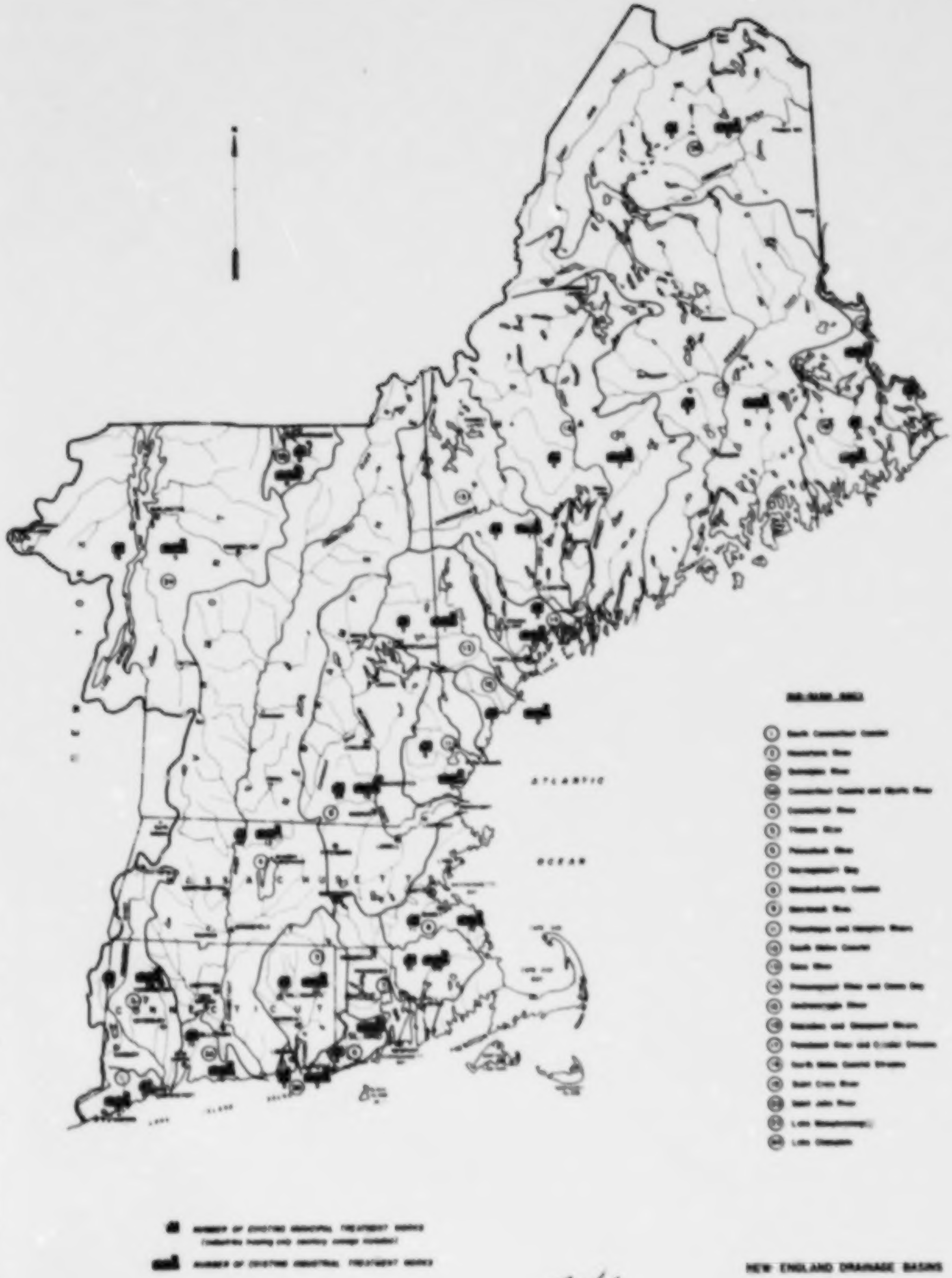
NEW ENGLAND DRAINAGE BASINS

SOURCES OF POLLUTION

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL

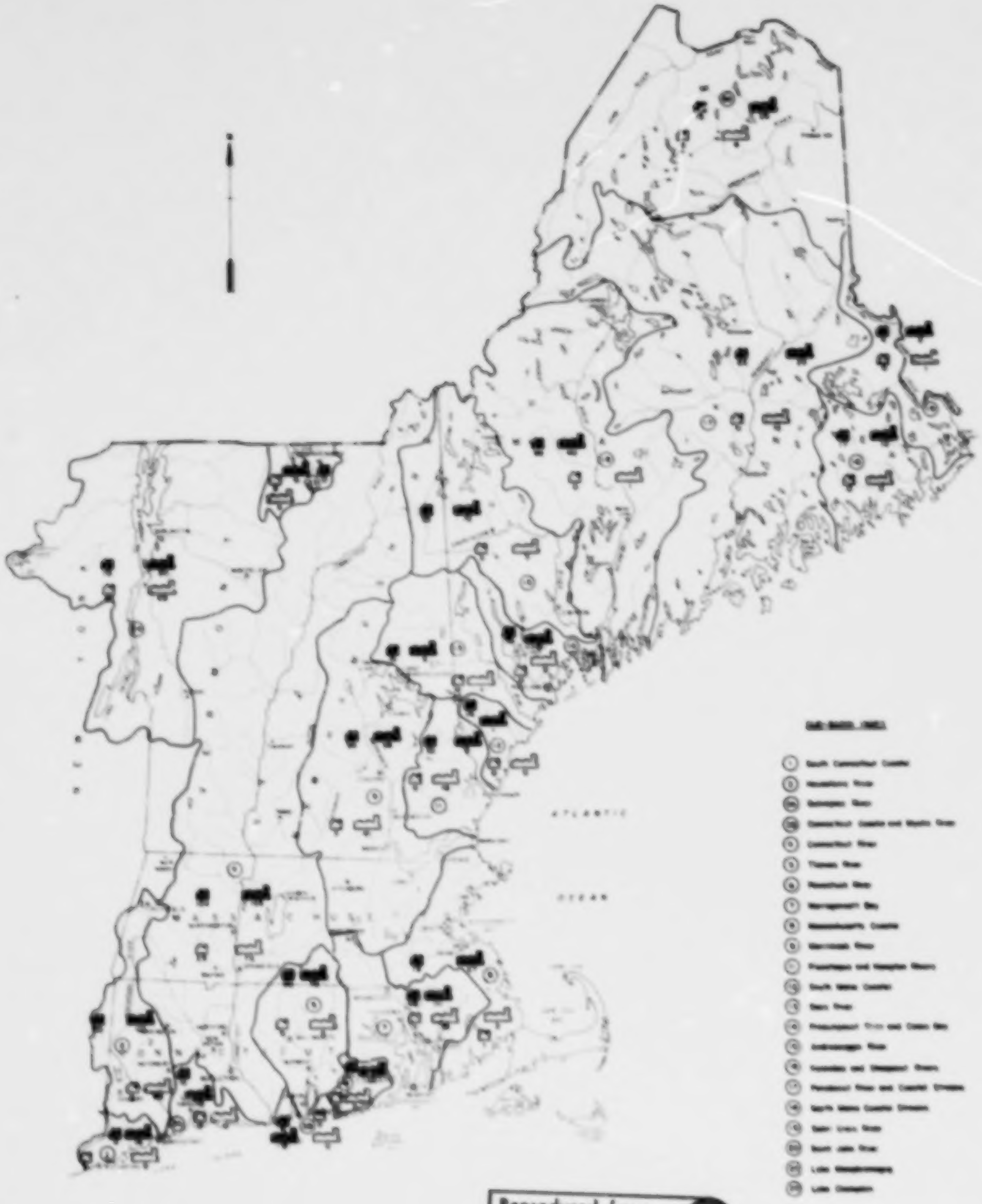
MAP NO. 1

993281 O - 51 (Face p. 14) No. 1


ATLANTIC
OCEAN
NUMBER OF EXISTING MUNICIPAL TREATMENT WORKS
NUMBER OF EXISTING INDUSTRIAL TREATMENT WORKS
SCALE OF MILES

15-b

NEW ENGLAND DRAINAGE BASINS
EXISTING TREATMENT WORKS
FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP No. 2


ATLANTIC
OCEAN
SUB-BASIN INDEX
South Connecticut Coastal
Housatonic River
Quinnipiac River
Connecticut Coastal and Mystic River
Connecticut River
Thames River
Blackstone River
Narragansett Bay
Massachusetts Coastal
Merrimack River
Piscataqua and Hampton Rivers
South Maine Coastal
Saco River
Presumpscot River and Casco Bay
Androscoggin River
Kennebec and Sheepscot Rivers
Penobscot River and Coastal Streams
North Maine Coastal Streams
Saint Croix River
Saint John River
Lake Memphremagog
Lake Champlain

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● NUMBER OF MUNICIPAL PROJECTS REQUIRED (Industry having only sanitary sewage included)

○ NUMBER OF MUNICIPALITIES WITH PROJECT REQUIREMENTS UNDETERMINED (Industries having only sanitary sewage included)

■ NUMBER OF INDUSTRIAL PROJECTS REQUIRED

□ NUMBER OF INDUSTRIES WITH PROJECT REQUIREMENTS UNDETERMINED

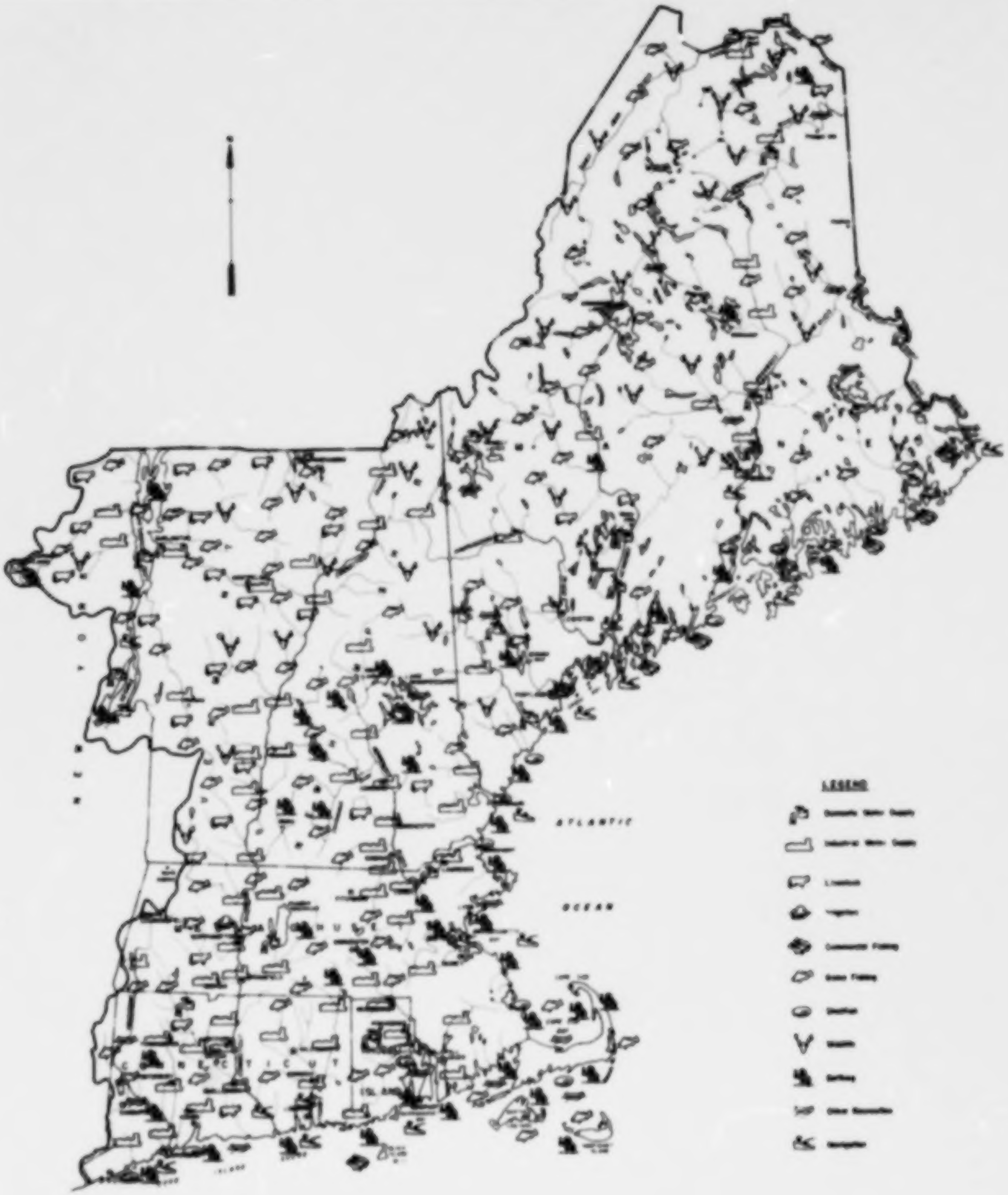
15-C

SCALE OF MILES

NEW ENGLAND DRAINAGE BASINS
PROJECTS REQUIRED

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP No. 3

953281 O - 51 (Face p. 14) No. 3


ATLANTIC
OCEAN
LEGEND
Domestic Water Supply
Industrial Water Supply
Livestock
Irrigation
Commercial Fishing
Game Fishing
Shellfish
Wildlife
Bathing
Other Recreation
Navigation

15-d

SCALE OF MILES

NEW ENGLAND DRAINAGE BASINS

EXISTING PRIMARY WATER USES

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL

MAP NO. 4

ments to abate pollution at these sources have been determined by the water pollution control agencies and many of the violators have commenced action to provide the necessary projects.

Table H. Status of treatment works projects to abate pollution, September 1950

Status of project	**Number**	
	Municipal	**Industrial**
No formal action	618	712
Abatement ordered	23	21
Plans under preparation	16	8
Final plans approved	17	1
Construction awaiting financing	5	0
Under construction	13	6
Status undetermined	96	303

SUB-BASIN REPORTS

SOUTH CONNECTICUT COASTAL STREAMS SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The South Connecticut Coastal Streams Sub-Basin comprises the area between the Housatonic River watershed and just beyond the New York State line. The sub-basin drains the most southwestern part of Connecticut and a very small part of New York. The principal streams in the sub-basin are the Saugatuck, Poquonock, Norwalk and Byram Rivers, of which the largest is the Saugatuck. The Saugatuck is about 20 miles long and drains an area of about 90 square miles. The total area of this sub-basin is approximately 350 square miles.

Near the ocean the terrain is typically flat coastal plain, but a few miles beyond the country becomes rolling. Rock formation is principally sandstone and shale with some traprock and granite. Over one-third of the area is in cleared farm land and large areas along Long Island Sound are classified as urban. The inland regions of the sub-basin are largely taken up by suburban estates.

Precipitation averages about 45 inches annually and is well distributed through the year. Winter temperatures average 30° F. and summer temperatures average about 70°F. A gaging station is maintained on the Saugatuck River and records indicate that the run-off from the whole sub-basin annually averages about 630 cubic feet per second.

Economic Development

The actual amount of tilled land is small but farming as practiced is intensive. The principal farm products are from dairying, poultry, and truck gardening and these find a ready market in the nearby communities and urban areas. The value of all farm products sold in 1945 was a little more than $3,000,000.

Although this sub-basin is small, it has been intensely industrialized. In recent years there was a large movement of industry from metropolitan New York into the urban areas of the sub-basin. There are a number of important industrial cities the largest of which are Bridgeport, Norwalk, and Stamford. There are an estimated 950 manufacturing plants within the sub-basin. Industry is very well diversified and the leading products are textile, primary metal, machinery, fabricated metal, rubber, leather and food. There are an estimated 105,000 manufacturing employees whose salaries and wages totaled some $300,000,000 in 1947. The value added to products by manufacture during that year was about $505,000,000.

Recreational opportunities along the coast attract many summer residents as well as local citizens. Excellent bathing beaches are available and so popular as to generally be overcrowded. There are extensive shellfishing grounds along the coast.

The 1950 population of the sub-basin is estimated to be over 400,000. The largest city is Bridgeport with a 1950 population of 158,678 and Stamford is next largest at 73,869.

Uses of the Water Resources

Extensive use is made of the water resources of the South Connecticut Coastal Streams Sub-Basin except for public water supply. Use of the waters for recreational purposes is probably most extensive. There is considerable use for industrial water supply and other important uses are commercial fishing, navigation and shellfish operations.

POLLUTION DATA

Damages to the Water Resources from Pollution

The Byram River has been damaged by pollution and is unsatisfactory for industrial process water and some recreational uses.

The Noroton River below Springdale has become unsatisfactory for use for recreational bathing and game fishing. The Norwalk River at Norwalk is unsuitable for game fishing because of pollution from that city.

Pollution from sources on the Saugatuck River causes the water downstream to be unsuitable for the taking of shellfish. A small unnamed brook entering Ash Creek in Fairfield is damaged by pollution for use as a wildlife habitat and for some recreational uses.

The lower Poquonock River and Bridgeport Harbor receive pollution from Bridgeport and some of these waters are rendered unsuitable for recreational bathing, game fishing, and commercial fishing.

Sources of Municipal and Industrial Pollution

Data on sources of municipal and industrial pollution are contained in Tables A_1 and B_1. There are nine municipal and one institutional source of sewage pollution from systems serving 318,800 persons. There are 26 source of industrial waste pollution. Industrial wastes originate principally in the primary and fabricated metal industries and from textile processing.

Existing Municipal and Industrial Treatment Facilities

Only one of the ten sources of sewage pollution has failed to provide facilities for sewage treatment. The number and types of sewage treatment works and the population served is given in Table C_1. Table D_1 shows the type and number of industries discharging wastes directly to watercourses and the treatment facilities provided. Seventeen of the sources of industrial wastes receive treatment.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Table E_1 shows the status of existing treatment facilities. All of the ten sources of municipal sewage pollution in the sub-basin except one are served by treatment works, 16 plants in all. Twelve of the treatment plants are adequate in design and operation, three are operated satisfactorily but overloaded and the status of treatment at one plant is undetermined.

Of the 26 sources of industrial pollution, 17 have been provided with treatment facilities. Twelve of the industrial waste treatment plants are adequate in design and operation and the remaining five are inadequate in capacity although three are satisfactorily operated.

Table F_1 shows that five industrial waste treatment works were completed during the period 1946 through June 1950. Data on amounts of wastes treated are unavailable. During this same period three sewage treatment projects to serve 50,600 persons were completed.

As shown by Table G_1, one new sewage treatment plant is required to serve 1,900 persons, three existing sewage plants serving a connected population of 209,250 require enlargements or additions and the requirements for one municipality to serve 25,000 persons have not been determined. No project is required of 12 sewage plants serving 82,660 persons. Nine sources of industrial wastes require construction of new treatment facilities, five require additions or enlargements to existing plants and no project is needed at 12 sources now adequately served by treatment works.

The status of treatment works projects to abate pollution is given in Table H_1. Two

Table A_1. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	8	260,810	224,928
Having population data available (Data on pollution load to watercourse incomplete or not available)	2	58,000	Not applicable
Total	10	318,810	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

Table B_1. *Sources* of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	None
Producing organic wastes	11	Undetermined.
Producing inorganic wastes	15	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	26	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_1.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	6	13[1]	311,650
Secondary	3	3	5,260
No treatment	1	0	1,900

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; and industries discharging sanitary sewage wastes directly to watercourse.

[1] One municipality served by seven primary treatment plants and another by two primary treatment plants.

sewage treatment projects are under construction, one plant is awaiting financing before starting construction and final plans for a treatment plant for one municipality have been approved. The status of one sewage treatment project is undetermined. No formal action has been taken on any of the 14 industrial waste treatment projects needed.

Municipalities and Industries Requiring Improvements to Abate Pollution

Table I_1 is a list of sources of pollution requiring improvements for abatement. The names of manufacturing establishments are not published in accordance with the policies of several of the state water pollution control agencies.

Table D_1. Existing treatment facilities, industrial*

Type industry	Number of plants[1]	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products..	2	2	0	0
Textile mill products......	4	2	2	0
Lumber and wood products...	—	—	—	—
Paper and allied products.................	2	2	0	0
Chemical and allied products.................	2	2	0	0
Products of petroleum and coal.....................	—	—	—	—
Rubber products............	1	0	1	0
Leather and leather products................	—	—	—	—
Primary metal industries...	3	1	2	0
Fabricated metal products................	9	5	4	0
Miscellaneous..............	3	3	0	0
Totals................	26	17	9	0

*Industries having separate outlets and discharging wastes directly to watercourse.

[1] Data on methods of disposal for employee sanitary sewage:

11 industries discharge to municipal sewers.
9 industries provide satisfactory treatment.
4 industries provide treatment of unknown efficiency.
2 industries have undetermined methods of disposal.

Table E_1. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	16[1]	12	3	1	15	0	1
Industrial	17	12	5	0	15	2	0

[1] One municipality served by seven primary treatment plants and another by two primary treatment plants.

Table F_1. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	1	500	0	--
1947	1	100	2	35 + plating
1948	0	--	2	100 + plating
1949	0	--	1	oil
To July 1950	1	50,000	0	--

Table G_1. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	1	1,900	9[1] [2] [3]
Enlargement or additions to existing plant	3[5]	209,250	5[2] [4]
Replace existing plant	0	0	0
No project required	12[6]	82,660	12
Undetermined	1	25,000	0

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] 5 plants have plating wastes.

[2] 1 plant has pickling wastes.

[3] 1 plant has oil wastes.

[4] 2 plants have plating wastes.

[5] Includes two treatment plants serving one municipality.

[6] Includes seven treatment plants serving one municipality.

Table H_1. Status of treatment works project to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	[illegible]	14
Abatement ordered	0	0
Plans under preparation	0	0
Final plans approved	1	0
Construction awaiting financing	1	0
Under construction	2[1]	0
Status undetermined	1	0

[1] One municipality with two treatment plants under construction.

Table I_1. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Sources of pollution	Location	Population served or equivalent number people**	Project requirements
		CONNECTICUT MUNICIPALITIES		
Long Island Sound	Municipal	Bridgeport	45,000	Add to existing plant[1]
do	do	do	131,250	do
do	do	Norwalk	33,000	do
Saugatuck River	do	Westport	1,900	New plant
		CONNECTICUT INDUSTRIES WITH INDUSTRIAL WASTES		
Poquonnock River	Gages and instruments	Bridgeport	N[2]	New plant
Bridgeport Harbor	Brass and copper sheets and tubes	do	N[2]	do
Yellow Mill Creek	Hot and cold rolled steel	do	N[3]	do
Tributary of Ash Creek	Refine gold and silver	Fairfield	N[2]	Add to existing plant
Byram River	Felt	Greenwich	N	do
Norwalk River	Metal frames for ladies' handbags	Norwalk	N[2]	do
do	Lace	do	N	New plant
do	Tires and batteries	do	N[4]	do
Noroton River	Rolled copper and brass	Springdale	N[3]	Add to existing plant
Stamford Harbor	Coated cloth	Stamford	N	do
do	Locks	do	N	New plant
do	Steel roller and ball bearings	do	N[2]	do
do	Postage meters	do	N[2]	do
Saugatuck River	Yarn and wicks	Westport	N	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = Information unavailable.

[1] New plant in operation September 1950.

[2] Plating.

[3] Pickling.

[4] Oils.

HOUSATONIC RIVER SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Housatonic River Sub-Basin drains 1,234 square miles of western Connecticut, 499 square miles of western Massachusetts and 215 square miles of southeastern New York, a total drainage area of 1,948 square miles. The river rises in the Berkshire Hills of Massachusetts and from Pittsfield flows in a generally southern direction for about 150 miles where it enters Long Island Sound between Milford and Stratford, Conn. The basin has a maximum length of about 100 miles and its maximum width is about 45 miles.

The northern course of the river in Massachusetts is through a steep, narrow valley in mountainous country. The valley broadens in Connecticut, and the country is generally rolling until the flat coastal plain is reached and where the basin narrows sharply. Rock formation is almost entirely granite, covered with glacial deposits of sand and gravel. About one-fourth of the basin is in cleared farmland, principally pasture land. The remainder of the basin is wooded with mixed hardwoods, most of which are second- and third-growth stands.

The average annual precipitation in the northern portions of the basin is about 42 inches and is about 47 inches near the coast, the average for the basin being 44 inches annually. Temperature averages vary widely between the northern and southern portions of the basin, ranging from 20° to 30°F. in the winter and 64° to 70°F. in the summer, the lower temperatures prevailing in the northern regions.

The principal tributaries of the Housatonic are the Naugatuck, Still, Pomperaug, Shepaug and Tenmile Rivers. There are 12 stream gaging stations in the basin, and over the years of record the total run-off in the basin has averaged 3,190 cubic feet per second.

Economic Development

About one-third of the basin is in cleared farmland that is somewhat below the average in fertility of lands in Massachusetts and Connecticut. The most productive land is in the southern portion of the basin. Livestock and livestock products account for nearly 90 percent of the farm income which, in 1945, was an estimated $18,000,000. In the southern portion of the basin a large number of farms have been converted to country estates and farming is more in the nature of a rich man's hobby. These "gentlemen farmers" have done much to raise the value of farmland in this area.

The northern section of the basin from Dalton to Great Barrington, Mass., and the southern portion of the basin are highly industrialized areas. There are several "centers" of the industrial world in the Housatonic River Sub-Basin. Pittsfield, Mass., is well known for fine paper manufacture. Danbury, Conn., is the hat center of the world. The Naugatuck River valley is the brass center of the world, and long a leader in the fields of time-measuring instruments, rubber products, machinery and fabricated metal products. Textile mill products and chemical manufacture are other important industries in the basin. There are an estimated 920 manufacturing establishments in the Housatonic Sub-Basin that employed approximately 94,000 persons in 1947. During that year the total wages paid all manufacturing employees was about $268,500,000, and the value added to products by manufacture was some $583,000,000.

The Housatonic River valley contains some of the best recreational areas in New England. Probably the most famous such area is the Berkshire Hills. There are a number of large lakes that have been extensively developed for recreational purposes and there are numerous State parks and forests. There has been a tremendous investment of private and public money in recreational real estate. The basin has long been popular with sports enthusiasts and vacationists, and recreation not only serves the needs of the people but contributes substantially to the economy of the area.

From preliminary releases of the Bureau of the Census the 1950 population in the basin is estimated to be 473,100. There are 12 cities and urban towns, the largest of which is Waterbury, Conn., with a 1950 population of 104,209. Pittsfield is the largest city in the basin in Massachusetts and has a 1950 population of 53,055. The population of the basin has shown a steady and substantial gain through the years.

Uses of Water Resources

Extensive use is made of the water resources of the Housatonic Sub-Basin. In the Naugatuck River valley the maximum utilization is being approached. All public surface water supplies are taken from watersheds protected from pollution. The most economically important use of the waters is for industrial water supply and the most extensive use is for all types of water recreation. Other important uses are for livestock watering, wildlife habitat, navigation, transportation of wastes and some shellfishing operations.

POLLUTION DATA

Damages to Water Resources from Pollution

Damages to the water resources of the Housatonic River Sub-Basin have been extensive. A large portion of the main stem of the river and its principal tributaries in Massachusetts have been damaged for most uses. During critical periods, nuisance conditions exist in the East Branch and in the main stem in the towns of Lee and Great Barrington.

In the Connecticut portion of the basin damages have been greatest to the Naugatuck and Still Rivers. During critical periods, nuisance conditions prevail in the Still River below Danbury and in the Naugatuck River below Waterbury. There are other damages to the water resources in other parts of the basin, that range from exclusion of use for recreational bathing to suitability for use only for transportation of wastes without nuisance.

Sources of Municipal and Industrial Pollution

Data on sources of sewage pollution are summarized in Table A_2. There are 75 sources of sewage pollution having a total contributing population of some 311,000 persons. Included in the total are 33 sources of sewage pollution from industry. These plants have no industrial wastes but discharge sanitary sewage from a combined total of over 2,500 employees.

Table B_2 contains data on sources of industrial waste pollution. Including 46 plants believed to be discharging industrial wastes, and for which surveys are needed, there are 191 sources of industrial waste pollution in this sub-basin. Fourteen plants discharge organic wastes equivalent to the domestic wastes of 62,000 persons, 62 produce organic wastes of undetermined strength, 62 contribute inorganic wastes and the characteristics of wastes from 53 plants have not been determined.

Existing Municipal and Industrial Treatment Facilities

The available information on existing sewage treatment facilities in the Housatonic River Sub-Basin is given in Table C_2. Five municipalities and institutions and nine manufacturing plants have provided primary treatment for the sewage from about 52,000 persons. Twelve municipalities and institutions and three manufacturing establishments have secondary sewage treatment plants to serve a contributing population of 94,000. No treatment has been provided for the sewage from 165,000 persons residing in 25 communities or employed in 21 industrial plants.

Table D_2 contains data on existing industrial waste treatment facilities. Only 20 of the 191 sources of industrial waste pollution being discharged directly to watercourses receive treatment while the wastes from another 111 plants are discharged to watercourses without treatment. There are 60 manufacturing establishments known or suspected of producing wastes but the information on treatment or disposal facilities is not available.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Table E_2 summarizes the information on existing treatment facilities. Seventeen of the 29 sewage treatment works in operation are satisfactory in capacity and operation, nine are inadequate in design, and the adequacy of three plants has not been determined. Six of the 23 sewage plants that are operated satisfactorily are inadequate because of overloading. Eleven of the 20 industrial waste treatment plants are satisfactory in design and operation while seven are not adequate. Two industrial waste treatment plants require determination of adequacy of capacity and operation. One of the 11 plants operated satisfactorily is inadequate because the loading exceeds the capacity.

Progress in pollution abatement is given in Table F_2. In 1946 an industrial waste disposal plant was completed to treat wastes equivalent to the domestic sewage of 1,650 persons. Another industrial waste treatment project was completed in 1949 but the amount of waste being treated is unavailable. Early in 1950 two sewage treatment plants to serve a connected population of 67,000 were completed and placed in operation.

Requirements for sewage and industrial waste treatment are summarized in Table G_2. Forty-one new sewage treatment projects to serve 165,000 persons and 106 new industrial waste treatment projects are required. Nine existing sewage treatment works serving 97,000 persons and five existing industrial waste treatment plants need enlargements or additions to provide satisfactory treatment. Two existing industrial waste treatment facilities need to be replaced with adequate treatment plants. The requirements for five small sources of sewage pollution from 600 persons and for 66 known or suspected sources of industrial waste pollution need to be determined. The sewage from approximately 49,000 persons in 16 communities and institutions and four industrial plants is adequately treated and these require no projects.

The status of treatment works projects to abate pollution is summarized in Table H_2. No formal action has been taken to abate pollution at 40 sources of sewage pollution and 113 sources of industrial waste pollution. Four municipalities have been ordered to construct sewage treatment plants and three others have final plans approved for such works. Three sewage treatment plants are under construction and the status at five sources of sewage pollution and 66 known or suspected sources of industrial waste pollution is undetermined.

Municipalities and Industries Requiring Improvements to Abate Pollution

A compilation of the sources of pollution known to require improvements to abate pollution is given in Table I_2. The names of manufacturing establishments are omitted in compliance with the policies of several of the New England States.

Tables A_2 through I_2 follow.

Table A_2. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	71[1]	262,984	205,740
Having population data available (Data on pollution load to watercourse incomplete or not available)	4[2]	48,175	Not applicable
Total	75	311,159	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] Includes 31 industries having sanitary sewage only from 2,357 employees.

[2] Includes 2 industries having sanitary sewage only from 175 employees.

Table B_2. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	14	62,071
Producing organic wastes	62	Undetermined
Producing inorganic wastes	62	Not applicable
Producing wastes of undetermined type	53[1]	Undetermined
Total	191	--

*Industries having separate outlets and discharging wastes directly to watercourse.

[1] Includes 46 plants suspected of pollution, the kinds and/or disposition of wastes being undetermined and for which surveys are needed.

Table C_2.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	14[1]	14	51,979
Secondary	15[2]	15	94,050
No treatment	46[3]	0	165,130

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] Includes 9 industries having only sanitary sewage from 354 employees.

[2] Includes 3 industries having only sanitary sewage from 20 employees.

[3] Includes 21 industries having only sanitary sewage from 2,158 employees.

Table D_2. Existing treatment facilities, industrial*

Type of industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products..	8	3	1	4
Textile mill products......	39	2	33	4
Lumber and wood products...	0	0	0	0
Paper and allied products..	15	2	13	0
Chemical and allied products......................	12	2	4	6
Products of petroleum and coal......................	4	2	2	0
Rubber products............	4	0	2	2
Leather and leather products......................	3	1	2	0
Primary metal industries...	8	0	7	1
Fabricated metal products..	83	4	39	40
Miscellaneous	15	4	8	3
Total....................	191	20	111	60

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_2. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	29	17	9	3	23	1	5
Industrial	20	11	7	2	11	6	3

Table F_2. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	---	1	1650
1947	0	---	0	0
1948	0	---	0	0
1949	0	---	1	Not available
1950	2	67,000	0	0

Table G_2. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	41[1]	164,751	106
Enlargement or additions to existing plant	9[2]	97,000	5
Replace existing plant	0	0	2
No project required	20[3] [5]	48,779	12[6]
Undetermined	5[4]	629	66

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] Includes 19 industries having sanitary sewage only from 1983 employees.

[2] Includes 5 industries having sanitary sewage only from 220 employees.

[3] Includes 4 industries having sanitary sewage only from 125 employees.

[4] Includes 4 industries having sanitary sewage only from 204 employees.

[5] 3 communities with total contributing population of 204 to abate pollution by adequate individual sewage disposal methods.

[6] 1 industrial waste will not require treatment.

Table H_2. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	40	113
Abatement ordered	4	0
Plans under preparation	0	0
Final plans approved	3	0
Construction awaiting financing	0	0
Under construction	3	0
Status undetermined	5	66

Table I_2. Project list - municipalities and industries requiring improvements for abatement of pollution*

Housatonic River Sub-Basin, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		CONNECTICUT MUNICIPALITIES		
Housatonic River	Municipal	Kent	200	New plant
do	do	New Milford***	2,500	do
do	do	Shelton	9,000	do
do	do	Derby	7,500	do
do	do	Stratford	25,000	Add to existing plant
Still River	do	Danbury	23,000	do
do	do	Bethel***	2,000	New plant
Naugatuck River	do	Thomaston***	1,000	do
Steel Brook	do	Oakville F.D.***	2,500	do
Naugatuck River	do	Waterbury	90,000	do
do	do	Naugatuck	12,000	do
do	do	Beacon Falls***	1,000	do
do	do	Seymour***	3,000	do
do	do	Ansonia	19,000	do

See footnotes at end of table.

Table I$_2$. Project list - municipalities and industries requiring improvements for abatement of pollution*--Continued

Housatonic River Sub-Basin, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		CONNECTICUT INDUSTRIES WITH SANITARY SEWAGE ONLY		
Housatonic River	Sanitary sewage (11 plants)	Shelton	648	New plant (11)
do	Sanitary sewage	Derby	910	do
Still River	Sanitary sewage (2 plants)	Danbury	130	New plant (2)
do	Sanitary sewage	do	90	Add to existing plant
Beaver Brook	do	Bethel	235	New plant (3)
do	do	do	70	Add to existing plant
Pootatuck River	do	Sandy Hook	50	New plant
do	do	do	20	Add to existing plant
do	do	do	20	do
do	do	Newtown	20	do
		CONNECTICUT INDUSTRIES WITH INDUSTRIAL WASTES		
Housatonic River	Bleach and dye cloth	New Milford	N	New plant
do	Bleach and dye pile fabrics	Shelton	N	do
do	Plating	do	N[1]	do
do	Steel and iron wire	do	N[2]	do
do	Plating	do	N[1]	do
do	Bead chains	do	N[4]	do
do	Brass and copper products	do	N[4]	do
do	Plating	do	N[1]	do
do	Domestic gas	do	N	do
do	Tacks	do	N[1]	do
do	Sponge rubber	do	N	do
do	Pins	do	N[1]	do
do	Laundry	Derby	N	do
do	Dye and print cotton	do	4,608	do
do	Nickel and tin plate	do	N[1]	do
do	Plating	do	N[1]	do
do	Sand washing	Stratford	N	do
do	do	do	N	do
do	do	do	N	Add to existing plant
do	Brake linings	do	N	do
do	Laundry	do	N	New plant
Still River	Ball bearings	Danbury	N[1]	do
do	Felt hat	do	N	do
do	Hats	do	N	do
do	Fur wool	do	N	do
do	Hats	do	N	do
do	Hats	do	N	do
do	Hats	do	N	do
do	Hatters and textile fur	do	N	do
do	do	do	N	do
do	Hats	do	N	do

See footnotes at end of table.

Table I_2. Project list - municipalities and industries requiring improvements for abatement of pollution*—Continued

Housatonic River Sub-Basin, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
Still River	Stainless steel and silver	Danbury	N^1	New plant
do	Hats	do	N	do
do	Hats	do	N	do
do	Straw and felt hats	do	N	do
do	Hats	do	N	do
do	Rough fur felt hats	do	N	do
do	Wool felt hat bodies	do	N	do
do	Aluminum foil	do	N^3	do
do	Cosmetic cases	do	N^5	do
Beaver Brook	Rough fur felt hat bodies	Bethel	N	do
do	Hatter's fur	do	N	do
do	Hat leathers	do	N	do
do	Rough hats	do	N	do
do	Men's rough hats	do	N	do
do	Sheepskin leather	do	N	do
do	Phenolic resins	do	N	do
do	Rubber chemicals	do	N	do
do	Light structures	do	N	do
do	Fur felt hat bodies	do	N	do
Pootatuck River	Custom moulding	Sandy Hook	N	do
Pomperaug River	Traps and tacks	South Britain	N^2	do
Hall Meadow Brook	Sporting goods and tools	Torrington	N	do
Naugatuck River	Needles and needle bearings	do	$N^{1,3}$	do
do	Brass mill products	Thomaston	N	do
do	Time instruments	do	N^3	do
do	Special machinery	do	N^3	do
do	Screw machine products	do	N^3	do
do	Plated buttons	do	N^1	do
Steel Brook	Threads	Watertown	N	do
do	Pruning tools	Oakville	N	do
do	Plumbing fixtures and buckles	do	N	do
do	Pins, tacks, metal stampings	do	N	do
Naugatuck River	Copper, brass and bronze	Waterbury	N^5	New plants
do	do	do	$N^{1,5}$	do
do	do	do	N^5	do
do	Measuring instruments	do	N^1	do
Tributary of Naugatuck River	Candy	Naugatuck	N	Add to existing plant
Naugatuck River	Footwear	do	N	New plant
do	Tools	do	N^1	do
do	Aircraft temperature instruments	do	N^1	do
do	Ice cream	do	N	do
do	Rubber chemicals	do	N	do

See footnotes at end of table.

Table I_2. Project list - municipalities and industries requiring improvements for abatement of pollution*--Continued

Housatonic River Sub-Basin, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
Naugatuck River	Mirrors	Naugatuck	N[6]	New plant
do	Copper floats	do	N[5]	do
Tributary of Naugatuck River	Copper products	do	N[1]	do
do	Copper and electrogalvanizing	do	N[1]	do
Naugatuck River	Synthetic rubber	do	N	do
Bladens River	Insulated wire	Seymour	N	do
Naugatuck River	Copper sheets and rolls	do	N[2]	do
do	Non-ferrous wire and rod	do	N	do
Bladens River	Cellulose and tissue	do	N	Add to existing plant
Naugatuck River	Dye pile fabrics	do	N	New plant
do	Brass mill products	Ansonia	N[5]	do
do	Brass wire and rod	do	N[5]	do
do	Screw machine products	do	N[5,1]	do
do	Elastic webbing and lace	do	N	do
Beaver Brook	Finger nail clippers	do	N[1]	do
Naugatuck River	Shoe eyelets	do	N[1]	do
MASSACHUSETTS MUNICIPALITIES				
E. Branch Housatonic River	Municipal	Dalton	4,400	do
Housatonic River	do	Great Barrington F. D.	(3,000)	do
do	do	Housatonic		do
E. Branch Housatonic River	do	Hinsdale	700	do
Housatonic River	do	Lee	4,348	do
do	do	Lenox	2,380	Enlarge existing plant
do	do	Lenoxdale	320	New plant
do	do	Pittsfield	46,400	Enlarge existing plant
MASSACHUSETTS INDUSTRIES WITH SANITARY SEWAGE ONLY				
Housatonic River	Paper warehouse	Lenox	10	New plant
MASSACHUSETTS INDUSTRIES WITH INDUSTRIAL WASTES				
Housatonic River	Coated papers	Great Barrington	N	do
Onota Brook	Woolen cloakings	Pittsfield	4,092	do
E. Branch Housatonic River	Ledger paper	Dalton	N	do
do	Bond paper	do	N	do
do	do	do	N	do
do	do	do	N	do
do	Currency paper	Pittsfield	N	do

See footnotes at end of table.

Table I_2. Project list - municipalities and industries requiring improvements for abatement of pollution*—Continued

Housatonic River Sub-Basin, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
E. Branch Housatonic River	Laundry	Pittsfield	240	New plant
Onota Brook	Worsted yarns	do	1,584	do
Housatonic River	Sheets	Great Barrington	N	do
E. Branch Housatonic River	Transformers	Pittsfield	N[1]	do
Housatonic River	Printing papers	South Lee	N	do
do	Bedspreads	Housatonic	N	do
Goose Pond Stream	Glassine paper	E. Lee	N	do
Housatonic River	Gas plant	Pittsfield	N[3]	Add to existing plant
do	Writing paper	Risingdale	N	New plant
do	Condenser paper	Lenox	N	do
do	Cigarette paper	Lee	N	do
do	do	do	N	do
do	Paper and textile machinery	do	N	do
W. Branch Housatonic River	Ladies' coatings	Pittsfield	6,780	do
E. Branch Housatonic River	Woolen goods	Dalton	N	do
		NEW YORK MUNICIPALITIES		
Amenia Creek	Private sewers	Amenia	500	New plant
Tenmile River	do	Dover Plains	350	do
Webatuck Creek	do	Millerton	550	do
Swamp River	do	Pawling	700	do
Wassaic Creek	do	Wassaic	350	do
		NEW YORK INDUSTRIES WITH INDUSTRIAL WASTES		
Webatuck River	Laundry	Millerton	N	Replace existing plant
Swamp River	do	Pawling	N	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = Information unavailable or does not apply.

***Also require sewerage systems.

[1] - Plating.

[2] - Pickling.

[3] - Oils.

[4] - Degreasing.

[5] - Acids.

[6] - Grinding compounds.

QUINNIPIAC RIVER AND COASTAL STREAMS SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Quinnipiac River and Coastal Streams Sub-Basin includes the drainage area between the Housatonic River and the Connecticut River. The Quinnipiac is the principal river in this sub-basin and flows about 30 miles in a southerly direction before entering Long Island Sound. The Hammonasett River is the next largest, being about 16 miles in length. The Quinnipiac River drains an area of about 150 square miles and the total drainage area of the sub-basin is some 590 square miles.

Near the coast the terrain is relatively flat but becomes rolling country a short distance from the Sound. Sandstone and shale make up the principal rock formation. About one-third of the area is cleared farm land.

Rainfall averages about 45 inches per year. Summer and winter temperatures average about 70° and 30° , respectively. A gaging station is maintained at Wallingford on the Quinnipiac River, and records indicate that the average annual run-off in the sub-basin is approximately 1,120 cubic feet per second.

Economic Development

The amount of farmland actually in crops in this sub-basin is small but farming as practiced is intensive. The principal source of farm income is derived from the sale of dairy, poultry and truck garden products. These products find a ready market in nearby cities and urban areas. The value of all farm products sold in the sub-basin in 1947 was more than $12,000,000.

Although this sub-basin is small, it is highly industrialized and manufacturing is the most important activity to the economy of the area. There are a number of industrial centers and the two largest and most important are New Haven and Meriden. There are an estimated 1,100 manufacturing establishments and industry is well diversified. The leading products manufactured are machinery, hardware, silverware, clothing and firearms. There are an estimated 112,000 manufacturing employees whose salaries and wages in 1947 totaled some $320,000,000. The value added to products by manufacture during that period was approximately $535,000,000.

Recreational opportunities along the coast attract many summer residents and also serve local residents. Bathing beaches are so popular as to be overcrowded. The coastal area of this sub-basin is the most important shellfish area in Connecticut.

The 1950 population of the sub-basin is estimated at 535,000. The largest city is New Haven with an estimated 1950 population of 180,000. The second largest city is Meriden, the 1950 population being given as 43,706 in the preliminary census releases.

Uses of the Water Resources

Almost every normal use is made of the water resources of this sub-basin. The most extensive uses are for recreational bathing, game fishing, and industrial process waters. Other important uses are for public water supply, commercial fishing and shellfish operations, and navigation.

POLLUTION DATA

Damages to Water Resources from Pollution

The watercourses of this small sub-basin transport a considerable amount of pollution that has resulted in damages to the normal uses.

Wastes entering New Haven Harbor from New Haven render some of the harbor waters unsuitable for recreational bathing, game fishing and other recreational uses.

The lower Mill River is unsuitable for livestock watering and game fishing as a result of pollution by industrial wastes. The lower Branford River is also damaged for use in these purposes and in addition is unsuitable for recreational bathing.

Sources of Municipal and Industrial Pollution

Data on sources of pollution are contained in Tables A_{3A} and B_{3A}. There are 11 sources of sewage pollution and 48 sources of industrial waste pollution, most of which are inorganic wastes from the processing and fabricating of metal products.

Existing Municipal and Industrial Treatment Facilities

Tables C_{3A} and D_{3A} summarize the data on existing treatment facilities. The sewage from 12 sources serving 227,000 persons receives treatment in 13 plants and 2 sources serving 10,000 persons are discharging wastes untreated. Nineteen of the total of 48 sources of industrial wastes have been provided with treatment plants.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

The adequacy of existing treatment facilities is summarized in Table E_{3A}. Ten sources of sewage pollution are served by 13 treatment plants and of these, eight plants produce unsatisfactory effluents. All of the 13 sewage treatment plants are operated satisfactorily but treatment at eight plants is inadequate because of overloading. Of the 19 existing industrial waste treatment facilities only eight produce satisfactory results and the remaining 11 are inadequate in capacity.

Progress in construction of pollution abatement projects is given in Table F_{3A}. During the period 1946 through June 1950, one industrial waste treatment plant and one sewage treatment project serving 14,000 persons were completed.

Table A_{3_A}. Sources of pollution, municipal

Municipal-ities*	Sources of pollution (in number of munici-palities)	Population served by sewerage system	Amount of pollution discharged to water-course (in terms of equivalent number of people)**
Having data on pollution load dis-charged to watercourse	9[1]	236,705	143,829
Having popu-lation data available (Data on pollution load to watercourse incomplete or not available)	2[2]	560	Not appli-cable
Total	11	237,265	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries, discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] Includes one industry having sanitary sewage only from 30 employees.

[2] Includes two industries having sanitary sewage only from 560 employees.

Data on requirements for sewage and industrial waste treatment works are summarized in Table G_{3A}. New sewage treatment plants are needed by one community with a 10,000 contributing population and by one factory with 30 employees. Enlargements or additions to existing facilities are required of eight sewage treatment plants to adequately serve 53,000 persons. No project is required of five municipal sewage treatment plants that now satisfactorily serve a connected population of 174,000. Twenty-nine sources of industrial wastes require construction of new treatment facilities, 11 need enlargements or additions to existing plants to provide adequate treatment plants.

Table H_{3A} shows the status of treatment works projects to abate pollution. No formal action has been taken to abate pollution from nine sources of sewage pollution and from 37 sources of industrial waste pollution. Three manufacturing plants have been formally ordered to abate industrial waste pollution and one municipal sewage treatment plant is under construction.

Municipalities and Industries Requiring Improvements to Abate Pollution

A list of the sources of pollution requiring improvements to abate pollution is given in Table I_{3A}. The names of industrial establishments are omitted in compliance with the policies or laws of several of the New England States.

Table B_{3_A}. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	0
Producing organic wastes	9	Undetermined.
Producing inorganic wastes	39	Not applicable.
Producing wastes of undetermined type	0	Undetermined.
Total	48	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_{3_A}.

Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	6[1] [2]	6[3]	217,110
Secondary	4[4]	7	10,125
No treatment	2[1] [5]	0	10,030

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] One municipality provides primary treatment for part of sewage, but discharges some without treatment. Also listed as one source under "No Treatment."

[2] Includes one industry having sanitary sewage only from 110 employees.

[3] Includes one municipality with two treatment plants and one municipality whose sewage is treated by another community.

[4] Includes one industry having 4 treatment plants for 450 employees.

[5] Includes one industry having sanitary sewage only from 30 employees.

Table D_{3_A}. Existing waste treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products.................	3	3	0	0
Textile mill products..................	0	--	--	--
Lumber and wood products..................	0	--	--	--
Paper and allied products..................	2	2	0	0
Chemical and allied products..................	3	0	3	0
Products of petroleum and coal..................	1	1	0	0
Rubber products............	1	0	1	0
Leather and leather products..................	0	--	--	--
Primary metal industries................	7	2	5	0
Fabricated metal products..................	29	9	20	0
Miscellaneous...............	2	2	0	0
Totals..................	48	19	29	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_{3_A}. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	13[1]	5	8	0	13	0	0
Industrial	19	8	11	0	14	5	0

[1] Includes two industries having a total of five unsatisfactory sewage treatment facilities for 560 employees and also includes one city having two treatment plants.

Table F_{3A}. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	0	--	0	--
1948	0	--	1	1600
1949	0	--	0	--
1950	1	14,000	0	--

Table G_{3A}. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	2[1] [3]	10,030	29
Enlargement or additions to existing plant	8[2]	53,260	11
Replace existing plant	0	0	0
No project required	5[4]	173,975	8
Undetermined	0	0	0

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] Includes one industry having sanitary sewage only from 30 employees.

[2] Includes 2 industries having sanitary sewage only from 560 employees, treated in 5 treatment plants.

[3] Includes one municipality, which, although having two satisfactory treatment plants, requires one more to treat sewage from the rest of the city.

[4] Sewage from one municipality is treated by the facilities of another community. The two satisfactory treatment plants cited in footnote [3] are listed here.

Table H_{3A}. Status of treatment works project to abate pollution, September, 1950

Status of project	Number	
	Municipal	Industrial
No formal action	9	37
Abatement ordered	0	3
Plans under preparation	0	0
Final plans approved	0	0
Construction awaiting financing	0	0
Under construction	1	0
Status undetermined	0	0

Table I$_3$A. Project list - municipalities and industries requiring improvements for abatement of pollution,* September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
CONNECTICUT MUNICIPALITIES				
Long Island Sound	Municipal	New Haven (East side)	10,000	New plant(under construction since Sept. 1950)
Quinnipiac River	do	Southington	5,700	Add to existing plant
do	do	Wallingford	12,000	do
do	do	Meriden	35,000	do
CONNECTICUT INDUSTRIES WITH SANITARY SEWAGE ONLY				
Tenmile River	Sanitary Sewage	Milldale	30	New plant
Quinnipiac River	do	Southington	110	Add to existing plant
Indian River	do	Orange	450	Add to existing plants (4)
CONNECTICUT INDUSTRIES WITH INDUSTRIAL WASTES				
Wepawaug River	Locks, stampings	Milford	N^1	New plant
Long Island Sound	Electric motors	do	N^{11}	do
do	Brass hardware	do	N^1	do
New haven Harbor	Rubber goods	New Haven	N	do
New Haven Harbor	Steel boats	New Haven	N^2	do
Quinnipiac River	Electronic equipment	Plainville	N^1	do
do	Photographic accessories	do	N^1	Add to existing plant
do	Steel tanks	Milldale	N^1	New plant
do	Nuts and bolts	do	N^2	Add to existing plant
Eight Mile River	Electric control devices	Plantsville	N^1	do
Quinnipiac River	Hand tools	Southington	N^1	New plant
do	Plumbing and heating supplies	do	$N^{1,2}$	Add to existing plant
do	Screws, tools	do	N^1	New plant
do	Aluminum tubes	do	N^5	Add to existing plant
do	Steel wire	New Haven	N^2	do
do	Service Locomotives	do	N^3	do
do	Cold rolled steel	Hampden	N^2	do
do	Marine transmissions	New Haven	N^{12}	New plant
do	Dye intermediates	No. Haven	N	do
do	Carbide gas	do	N^{13}	do
do	Plastics and resins	Wallingford	N^{14}	do
do	Sterling and plated silver	do	N^1	do
do	Cold rolled steel	do	N^2	do
Sodom Brook	Silver holloware	Meriden	N^1	do
do	Engine filters	do	N^3	do
Harbor Brook	Light fixtures	do	N^1	do
do	Silver plate	do	N^1	do
do	Ball bearings	do	N^1	do
Clark Brook	Silver plate	do	N^1	do
do	do	do	N^1	do

See footnotes at end of table.

Table I$_{3A}$. Project list - municipalities and industries requiring improvements for abatement of pollution,* September 1950—continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
Clark Brook	Aluminum and brass castings	Meriden	$N^{1\ 2}$	New plant
			N^2	do
do	Telephone equipment	do	N^1	do
Jordan Brook	Electrical appliances	do	N^1	do
do	Non-ferrous castings	do	N^2	do
Mill River	Paperboard	New Haven	N	Add to existing plant
do	do	do	N	do
Willow Brook	Metal stampings	Cheshire	N^1	New plant
Branford River	Steel wire	Branford	N^2	do
do	Steam fittings	do	N^2	do
West River	Laundry	Guilford	N	Add to existing plant

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = Information not available or does not apply.

[1] Plating.
[2] Pickling.
[3] Oils.
[4] Degreasing.
[5] Acids.
[6] Grinding compounds.
[7] Copper.
[8] Fly-ash.
[9] Sand washing.
[10] Rouge abrasives.
[11] Cleaning.
[12] Heat treating.
[13] Lime water.
[14] Formaldehyde.

CONNECTICUT COASTAL STREAMS AND MYSTIC RIVER SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Connecticut Coastal Streams and Mystic River Sub-Basin drains the coastal areas in Connecticut between the Connecticut and Thames Rivers and between the Thames and Pawcatuck Rivers. The Mystic River is the largest of the coastal streams in this sub-basin and is about 10 miles long. The Niantic River is the second largest stream. The drainage area of all the coastal streams in this sub-basin is about 120 square miles.

The area along the coastal plain is flat and there is much swampland. Away from the Sound the terrain becomes somewhat rolling. The underlying rock is principally granite with a heavy overburden of glacial sand and gravel. About one-fourth of the drainage area is in farmland and the interior regions are largely wooden with second growth hardwoods predominating.

Rainfall averages about 44 inches annually. Being a coastal area, temperatures in the sub-basin are moderate. Summer temperatures average about 67°F. and winter temperature averages vary from 30° to 32°F. There are no stream gaging stations in the sub-basin and no run-off figures are available.

Economic Development

The land in the sub-basin is not very well suited for farming. The principal agricultural activities are in livestock and truck gardening, with the sale of dairy and poultry products accounting for nearly 90 percent of the farm income. The value of all farm products sold in 1945 was approximately $1,500,000.

Industry is the main source of income for the residents of the area. The textile manufacturing plants account for most of the employment. There are an estimated 60 manufacturing plants in the sub-basin that employ approximately 8,000 persons. The total income of all manufacturing employees in 1947 was approximately $24,000,000, and the value added to products by manufacture was an estimated $41,000,000.

Recreation as an industry has been developed to a rather large extent. There are several State parks and forests and there are areas regulated for game hunting and fishing. There are a number of excellent beaches along the shores of Long Island Sound.

The 1950 population of the sub-basin is estimated to about 29,500 persons. The Mystic Fire District is the largest municipality in the sub-basin, with an estimated 1950 population of 5,000. The town of Stonington is the only urban area in the sub-basin and the 1950 population is approximately 12,200.

Uses of the Water Resources

The principal uses of the water resources of this sub-basin are for industrial and livestock water supply, game fishing, and recreational bathing.

POLLUTION DATA

Damages to Water Resources from Pollution

Although the streams in this small sub-basin transport an appreciable amount of pollution, the damages to normal water uses are reported to be small. The mouth of the Mystic River and inner Mystic Harbor are unsuitable for the taking of shellfish.

Sources of Municipal and Industrial Pollution

Data on sources of pollution are given in Tables A_{3B} and B_{3B}. There are 23 sources of pollution in the sub-basin, 12 from the discharge of sewage, from 800 persons and 11 from the discharge of industrial wastes. The principal industrial wastes are from textile mills and laundries.

Existing Municipal and Industrial Treatment Facilities

Of the total of 23 sources of pollution, three sources of sewage pollution and three sources of industrial wastes receive treatment. These and other data are included in Tables C_{3B} and D_{3B}.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Table E_{3B} shows the adequacy of existing treatment facilities. The three sewage treatment works are satisfactory, as are two of the industrial waste treatment plants. One other industrial waste treatment plant is not adequate in capacity.

Tables G_{3B} and H_{3B} show the requirements for and status of treatment works projects. Nine sources of sewage and eight sources of industrial waste pollution require new treatment plants. One industrial waste treatment plant requires enlargements. No formal action has been taken to abate any of the sources of pollution requiring improvements.

Municipalities and Industries Requiring Improvements to Abate Pollution

Table I_{3B} is a list of the sources of pollution requiring improvements to abate pollution. The names of firms have been omitted in keeping with the policies or laws of several of the New England States.

Table A_{3B}. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	12[1]	802	308
Having population data available (Data on pollution load to watercourse incomplete or not available)	0	0	Not applicable
Total	12	802	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers; or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] 10 industries have only sanitary sewage from 542 employees. Also included are one nursing home and one institution contributing sewage from a total of 260 patients.

Table B_{3B}. Sources of pollution industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	0
Producing organic wastes	10	Undetermined
Producing inorganic wastes	1	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	11	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_{3B}.

Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	1[1]	1	220
Secondary	2[2]	2	55
No treatment	9[3]	0	527

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] One institution having 220 patients and employees.

[2] Includes one industry having sanitary sewage only from 15 employees and one nursing home having 40 patients and employees.

[3] Includes 9 industries having sanitary sewage only, 527 employees.

Table D_{3_B}. Existing waste treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products................	0	--	--	--
Textile mill products.....	6	2	4	0
Lumber and wood products................	0	--	--	--
Paper and allied products................	0	--	--	--
Chemical and allied products................	2	1	1	0
Products of petroleum and coal................	0	--	--	--
Rubber products...........	0	--	--	--
Leather and leather products................	0	--	--	--
Primary metal industries................	0	--	--	--
Fabricated metal products................	0	--	--	--
Miscellaneous.............	3	0	3	0
Totals................	11	3	8	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_{3_B}. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	3	3	0	0	3	0	0
Industrial	3	2	1	0	3	0	0

Table F_{3_B}. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	0	--	0	--
1948	0	--	0	--
1949	0	--	0	--

Table G_{3B}. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	9	527	8
Enlargement or additions to existing plant	0	0	1
Replace existing plant	0	0	0
No project required	3	275	2
Undetermined	0	0	0

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

Table H_{3B}. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	9	9
Abatement ordered	0	0
Plans under preparation	0	0
Final plans approved	0	0
Construction awaiting financing	0	0
Under construction	0	0
Status undetermined	0	0

Table I_{3B}. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		CONNECTICUT INDUSTRIES WITH SANITARY SEWAGE ONLY		
Long Island Sound	Non-ferrous castings	Stonington	4	New plant
Mystic River	Paper tubes	Mystic	75	do
do	Radio cabinets	do	175	do
do	Cotton and nylon thread	do	35	do
do	Shipyard	do	35	do
do	Paper tubes	do	60	do
do	Machine shop	do	50	do
do	Lumber and hardware	do	18	do
Pequotsepos Creek	Razors	do	75	do
		CONNECTICUT INDUSTRIES WITH INDUSTRIAL WASTES		
Pataganset River	Cotton gauze, bandages	East Lyme	N	Add to existing plant
Jordan Cove	Woolen cloth	Jordan	N	New plant
Long Island	Velvet	Stonington	N	do
Mystic River	Cotton hand printing	Old Mystic	N	do
do	Velvet	Mystic	N	do
do	Laundry	do	N	do
do	Soap	do	N	do
Pequotsepos Creek	Laundry	do	N	do
do	Laundry	do	N	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = information not available or does not apply.

CONNECTICUT RIVER SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Connecticut River Sub-Basin is the largest in New England and has a drainage area of 11,320 square miles. The watershed is comprised of 3,110 square miles in New Hampshire, 3,960 in Vermont, 2,710 in Massachusetts, 1,425 in Connecticut, and 115 in Quebec Province, Canada. The sub-basin is about 300 miles long and at the maximum point 62 miles wide. The total length of the river is nearly 400 miles and it has a total fall to tidewater of over 1,600 feet.

The river rises in mountainous country and flows south through the steep, rugged White and Green Mountain ranges of New Hampshire and Vermont. In Massachusetts and northern Connecticut the river flows through a broad fertile valley between the Berkshire Hills to the west and the rolling hills of the eastern highlands. In central Connecticut the valley narrows sharply through irregular country, then into Long Island Sound through fairly level, swampy land.

Rock formation in the mountainous northern regions is almost entirely granite and in the broad valley it is chiefly sandstone and shale. In the western highlands of Massachusetts and Connecticut, there are outcroppings of traprock. Soils in the northern portions and along the rim of the sub-basin are generally sandy and stony. In the broad central valley the soil is excellent. About one-fourth of the sub-basin is in cleared farmland and only about 15 percent of this is in cropland. The remainder of the sub-basin is in woodland, mainly second- and third-growth hardwoods and conifers.

The average annual precipitation in the northern and southern portions of the sub-basin varies widely. In the northern portions it averages about 38 inches, and about one-fourth of the precipitation falls as snow. In the southern parts of the sub-basin the average annual precipitation is about 44 inches. Summer temperatures average from 60° to 68° F. and winter temperatures average from 14° to 30° F., the lower temperatures prevailing in the higher altitudes of the northern part of the sub-basin. There are a large number of stream gaging stations in the Connecticut River and its tributaries. Records indicate that the total run-off in the sub-basin through the years averages about 19,250 cubic feet per second.

Economic Development

The 1950 population of the sub-basin is estimated to be [illegible]75,000. The southern one-third of the area contains four-fifths of the total population and has a population density of about 250 persons per square mile, in contrast to 35 persons per square mile in the remainder of the sub-basin. Hartford, the capitol of Connecticut, is the largest city with a reported 1950 population of 176,623. Springfield, Mass. is the second largest city with a 1950 population figure of 162,601. There are six cities having populations of over 40,000 and 24 cities whose populations exceed 10,000.

Industry provides the largest source of income to the residents of the region. The greatest concentrations of industry occur in the southern portions of the sub-basin where are located some of the most important metropolitan and manufacturing centers of New England. Manufacturing pursuits are very well diversified and the region has enjoyed comparative economic stability. The production of metals, machinery, tools, textiles and paper are leading manufacturing activities. There are an estimated 2,700 manufacturing establishments that furnished employment for about 247,000 persons in 1947. During that year all manufacturing employees were paid a total of some $690,000,000 in salaries and wages, and the value added to products by manufacture was approximately $1,100,000,000.

Although industry is the chief source of income in the Connecticut Sub-Basin, agriculture contributes considerably to the total income. The southern portion of the sub-basin contains some of the most fertile land in New England. Farming is specialised for the most part and large areas are particularly devoted to the growing of tobacco. The proximity of the fertile valley to large urban market areas has made poultry raising, dairying and truck gardening profitable. In the northern parts of the sub-basin the farm woodlot contributes a small share to the farm income. The value of all farm products sold in the sub-basin in 1945 was an estimated $90,000,000.

Recreation is an important industry in the northern portions of the Connecticut River Sub-Basin and is important to the economy of New Hampshire and Vermont. The mountainous rim of the sub-basin provides excellent areas for sporting and recreational activities. A very large investment of private and public capital has been made in summer homes, resorts, public parks and reservations. There are two national parks and forests and more than 30 State parks and forests in the sub-basin. There are many sizable lakes, but most of these in the southern half of the watershed have been set aside for public water supplies.

Uses of the Water Resources

In this large river sub-basin, containing both rural and highly industrialized urban areas, almost every legitimate use is made of the water resources. Public water supply is the most important single use and industrial water supply is most important to the economy of the area. There is a widespread use of the waters for all types of recreational activities and this use is of significance to the economy of the northern parts of the sub-basin. Other prominent uses of the water resources are for livestock watering, wildlife habitat, irrigation and navigation. There is little use of the waters for commercial fishing and shell fishing operations. There has been some experimentation with irrigation that has indicated a more widespread use for this purpose would be advantageous. A conflicting and widespread use of the water resources has been made in transporting sewage and industrial wastes.

POLLUTION DATA

Damages to Water Resources from Pollution

There has been an appreciable damage to the water resources of the Connecticut Sub-Basin. In many cases the damages have occurred to the more important water uses. In the northern regions, streams have been damaged for recreational uses but, being largely a rural area, many streams remain undamaged. In the southern regions, damages have occurred to many streams used as sources of industrial water supply, the most important economic use. Throughout the sub-basin damages have resulted most frequently to uses for recreational bathing, game fishing and other recreational uses. Damages from pollution have been sustained by streams for use as livestock water supply, wildlife habitat and irrigation water supply. Damage has been greatest below areas of concentrated industrial activity and population centers. In a few places the amount of pollution transported is sufficient to degrade streams into nuisance conditions during critical periods. There have been no damages to public water supplies, because all sources are derived from watersheds protected from pollution.

Sources of Municipal and Industrial Pollution

Tables A_4 and B_4 summarize the data on the number of sources of pollution. The total number of separate sources of pollution discharging directly to watercourses is 436, of which 193 are attributable to sewage with a contributing population of 960,000 persons and 243 to industrial wastes. The majority of industrial wastes are organic in nature and, combined with the sewage discharged, the total pollutional load is probably in excess of a population equivalent of 2,000,000 persons.

Existing Municipal and Industrial Treatment Facilities

Of the total of 436 separate sources of pollution, 62 receive treatment. Fifty-two sources of sewage pollution tributary to 628,000 persons and 12 sources of industrial waste pollution are provided with waste treatment facilities. The sewage from 332,000 persons at 143 sources of pollution is discharged without treatment as are the industrial wastes from 231 manufacturing plants. These and other data are included in Tables C_4 and D_4.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Table E_4 summarizes the adequacy of existing treatment facilities. Thirty-five sewage and five industrial waste treatment facilities are providing a satisfactory degree of treatment, 17 sewage and six industrial waste treatment plants are inadequate because of overloading, and the status of adequacy of treatment at one industrial waste treatment facility is undetermined.

Progress in the construction of projects to abate pollution is indicated in Table F_4. During the period 1946 through June 1950, a total of seven industrial waste treatment projects were completed. Two of these plants are treating wastes equivalent to a total pollutional load of domestic sewage from 750 persons. The amount of wastes being treated by the other five industrial waste treatment plants has not been determined or is not calculable in ordinary terms of pollution measurement.

In 1947 one municipal sewage treatment plant project to serve 2000 persons was completed. A total of six sewage treatment projects were placed in operation in 1949 and these serve a connected population of 71,500. In 1950, as of July, one sewage treatment works to serve 2000 persons was completed.

The requirements for municipal and industrial waste treatment plants are summarized in Table G_4. To adequately serve a total connected population of nearly 300,000 persons, 117 new sewage treatment projects are needed. Fifteen existing sewage treatment plants now serving nearly 148,000 persons are inadequate and require enlargements or additions. Two sewage treatment plants that now serve a total of 18,500 persons are so inadequate in capacity as to require replacement with new plants. No project is needed at 38 sources of sewage pollution since existing treatment facilities satisfactorily serve a connected population of nearly 463,000. The requirements for treatment works projects at 23 sources of sewage pollution with a total tributary population of 33,000 persons need to be determined.

There are 153 sources of industrial wastes that require construction to abate pollution. Most will require new treatment plants but 37 may be able to solve disposal problems by connecting to municipal sewers. Six existing industrial waste treatment plants need enlargements or additions to provide satisfactory effluents and no project is required of nine sources that are receiving adequate treatment. The status of requirements to abate pollution from 75 sources of industrial wastes needs to be determined.

Table A$_4$. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	161[1]	849.941	575,014
Having population data available (Data on pollution load to watercourse incomplete or not available)	32	110,941	Not applicable.
Total	193	960,781	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] Including 53 industries discharging sanitary wastes only, 3648 employees.

Table H$_4$ shows the status of treatment works projects to abate pollution. No formal action has been taken to require needed treatment works and improvements for 113 sources of sewage and 142 sources of industrial waste pollution. Abatement of pollution by 10 sources of sewage pollution and 17 sources of industrial waste pollution have been ordered. Six sources of sewage pollution have final plans for treatment works approved and four others have such plans in preparation. One municipality has a sewage treatment plant under construction. The status of treatment works projects for 75 sources of industrial waste pollution and 23 sources of sewage pollution has not been determined.

Municipalities and Industries Requiring Improvements to Abate Pollution

A list of the sources of pollution in the Connecticut River Sub-Basin having known requirements to abate pollution is given in Table I$_4$. The names of municipalities and institutions are given but the names of manufacturers are omitted in accordance with the adopted policies or the laws of several of the New England States.

Table B$_4$. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	30	67,508
Producing organic wastes	163	Undetermined
Producing inorganic wastes	50	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	243	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_4.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	28[1] [2]	29	499,260
Secondary	22[3]	23	129,030
No treatment	143[4]	0	332,491

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] 10 industries with sanitary sewage only, 1,019 employees.

[2] Includes one municipality with two primary treatment plants.

[3] Includes one municipality with two secondary treatment plants.

[4] 43 industries with sanitary sewage only, 2,629 employees.

Table D_4. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products..	39	2	37	0
Textile mill products......	55	1	54	0
Lumber and wood products..................	11	0	11	0
Paper and allied products..................	51	2	49	0
Chemical and allied products..................	8	2	6	0
Products of petroleum and coal.....................	3	1	2	0
Rubber products............	3	0	3	0
Leather and leather products..................	5	1	4	0
Primary metal industries...	3	0	3	0
Fabricated metal products..................	39	2	37	0
Miscellaneous..............	26	1	25	0
Total..................	243	12	231	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_4. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	52	35	17	0	42	9	1
Industrial	12	5	6	1	11	0	1

Table F_4. Adequacy of existing treatment facilities

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	1	250
1947	1	2,000	1	500
1948	0	0	2	Data not available.
1949	6	71,500	1	do
To July 1950	1	2,000	2	do

Table G_4. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	117	298,545	153[4]
Enlargement or additions to existing plant	15[1]	147,776	6
Replace existing plant	2	18,515	0
No project required	38[2] [3]	462,955	9[5]
Undetermined	23	32,990	75

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] 2 plants require the addition of chlorination equipment only - serving 21,600 people.

[2] 3 small municipalities dispose of sewage by dilution; satisfactory disposal for the present.

[3] Includes two municipalities, each having two treatment plants all of which are satisfactory.

[4] 37 of these industries will either connect to public sewers or provide individual treatment.

[5] 4 small industries dispose of wastes by dilution; satisfactory disposal for the present.

Table H_4. Status of treatment works project to abate pollution, September, 1950

Status of project	Number	
	Municipal	Industrial
No formal action	113	142
Abatement ordered	10	17
Plans under preparation	4	0
Final plans approved	6	0
Construction awaiting financing	1	0
Under construction	0	0
Status undetermined	23	75

Table I4. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project[1] requirements
CONNECTICUT MUNICIPALITIES				
Connecticut River	Municipal	Thompsonville	9,000	Add to existing plant
do	do	Windsor Locks	4,500	New plant
do	do	Warehouse Point	800	do
do	do	East Hartford	18,000	do
do	do	Portland	2,500	do
Farmington River	do	Unionville	300	do
do	do	Farmington	2,000	do
Still River	do	Winchester	6,000	do
Hockanum River	do	Rockville	8,200	Replace existing plant
do	do	Manchester	24,000	Add to existing plant
Mattabasset River	do	New Britain	70,000	do
CONNECTICUT INDUSTRIES HAVING SANITARY SEWAGE ONLY				
Connecticut River	Machine tools	Windsor Locks	65	New plant
do	do	do	60	do
do	Foundry	Rocky Hill	180	do
do	Boat works	Essex	16	do
Connecticut River	Boat works	Essex	10	New plant
Scantic River	Woolen shoddy	Hazardville	16	do
Farmington River	Metal stamping	Collinsville	36	do
do	Axe manufacturing	do	500	do
do	Television accessories	Unionville	80	Add to existing plant
do	Steel ball manufacturing co.	do	50	New plant
do	Paper box co.	do	1	do
do	Machine shop	do	3	Add to existing plant
do	Spring manufacturing	do	63	do
Still River	Machine screw production	Winsted	18	New plant
do	Forge shop	do	25	do
Mad River	Insulated wire co.	do	150	do
do	Transformer co.	do	140	do
do	Paper box co.	do	14	do
do	Pocket knife co.	do	25	do
do	Name tape co.	do	10	do
Manufacturers Stream	Folding chair co.	do	23	do
do	Steel tool co.	do	46	do
Pequabuck River	Metal castings	Plainville	15	do
do	Screw machine co.	do	10	Add to existing plant
do	Spring co.	do	10	New plant
Hockanum River	Yarn co.	Talcottville	--	do
do	Furniture mfg.	Manchester	--	Add to existing plant
Willow Brook	Pickle co.	East Hartford	30	New plant
Salmon Brook	Tool design co.	Glastonbury	20	do
do	Wood working plant	do	7	do

See footnotes at end of table.

Table I4. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project[1] requirements
Salmon Brook	Testing instrument co.	Glastonbury	5	New plant
do	Tool mfg. co.	do	4	do
Candlewood Hill Brk.	Farm machine co.	Higganum	75	do
Pocotopaug Brk.	Bell mfg. co.	E. Hampton	35	do
do	Fish line mfg.	do	28	do
Moodus River	Twine and yarn co.	Moodus	20	do
do	Fish net co.	do	10	do
do	Machine shop	do	4	do
do	Auto repairing	do	10	do
do	Twine and cord mill	do	25	do
Succor Brook	Photographic mounting co.	East Haddam	16	do
Pattaconk Brk.	Wood products co.	Chester	30	do
Unnamed Brook	Wood boring tool co.	do	20	Add. treatment
Deep River	Soldering iron mfg.	Deep River	30	New plant
do	Piano parts co.	do	10	do
Falls River	do	Essex	750	do
do	Machine shop	do	15	do
do	Wood bit mfg. co.	do	60	do
Connecticut River	Boat dock co.	do	--	Add. treatment
CONNECTICUT INDUSTRIES HAVING INDUSTRIAL WASTES				
Connecticut River	Toy pistol co.	Cromwell	N	New plant
do	Laundry	Old Saybrook	N	do
Scantic River	Woolen co.	Somersville	N	do
do	do	Broad Brook	N	do
Farmington River	Textile mill	Unionville	N	do
do	do	do	N	do
do	Piano felt	do	N	do
do	Safety fuse	Simsbury	N	do
do	Insulating board	Windsor	N	do
Still River	Clock co.	Winsted	N	do
do	Textile mill	do	N	do
Mad River	Electric appliance	do	N	do
do	Hatter's fur	do	N	do
do	Plating co.	do	N	do
do	Chemical plant	do	N	do
do	Silk co.	do	N	do
do	Knitting mill	do	N	do
Manufacturers Stream	Hardware mfg. co.	do	N	do
do	Pin co.	do	N	do
do	Electric appliance co.	do	N	do
Pequabuck River	Plating co.	Plainville	N	do
do	Plating co.	do	N	Add to existing plant
do	do	do	N	New plant
Park River	Pipe & tube mfg.	West Hartford	N	do
do	Typewriter co.	Hartford	N	do
do	Screw mfg.	West Hartford	N	do
Piper Brook	Cutlery plant	New Britain	N	do
do	Hardware co.	do	N	do

See footnotes at end of table.

Table I_4. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project[1] requirements
Piper Brook	Screw co.	New Britain	N	New plant
do	Bearing co.	do	N	do
do	Machine tool co.	do	N	do
do	Harness hardware mfg.	do	N	do
do	Builders' hardware	do	N	do
do	Carpenters' tool mfg.	do	N	do
Pewter Pot Brk.	Slaughter house	East Hartford	N	Add to existing plant
Hockanum River	Paper mfg.	Manchester	N	New plant
do	do	East Hartford	N	do
do	do	do	N	do
do	Asbestos board	do	N	do
Lydall Brk.	Paper mfg.	Manchester	N	do
do	Fiber board	do	N	do
Willow Brk.	Aircraft engines	East Hartford	N	do
Salmon Brook	Fire extinguisher co.	Glastonbury	N	do
Roaring Brk.	Woolen mill	S. Glastonbury	N	do
Willow Brk.	Home appliance co.	New Britain	N	do
do	do	do	N	do
do	Hardware co.	do	N	do
do	Machine tool	do	N	do
do	Metal specialty co.	do	N	do
Coginchaug River	Textile printing	Middletown	N	do
Unnamed Brks.	Dairy products	Kensington	N	do
do	do	Berlin	N	do
do	do	do	N	do
do	do	do	N	do
do	Chemical co.	East Berlin	N	do
Sumner Creek	Textile co.	Middletown	N	do
Candlewood Hill Brook	Stencil paper co.	Higganum	N	do
do	Yarn co.	do	N	do
Pocotopaug Brk.	Wire products	East Hampton	N	do
do	Electroplating co.	do	N	do
do	Brass co.	do	N	do
do	Toy mfg.	do	N	do
do	do	do	N	do
Moodus River	Thread co.	Moodus	N	do
do	Twine and yarn co.	do	N	do
Pattaconk Brk.	Auger and bit mfg.	Chester	N	Enlarge existing plant
do	Laundry	do	N	New plant
Unnamed Brook	Wire products co.	do	N	do
do	Manicuring implements	do	N	do
Deep River	Brass goods co.	Deep River	N	do
do	Electric switch co.	do	N	do
do	Laundry	do	N	do
Falls River	Nut cracker mfg. co.	Westbrook	N	do
do	Pharmaceutical co.	Essex	N	do
do	Garage	do	N	do
do	Electrical products	do	N	do
Muddy River	Lamp shade co.	do	N	do
Unnamed Brk.	Food plant	Old Saybrook	N	Add to existing plant

See footnotes at end of table.

Table 14. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project[1] requirements
Connecticut River	Tinsel and yarn co.	Windsor Locks	N	Add to existing plant
do	Paper mill	do	N	do
do	do	do	N	do
do	Rayon mill	Rocky Hill	N	do
MASSACHUSETTS MUNICIPALITIES				
Connecticut River	Municipal	Northfield	50	New plant
do	School	do	500	do
do	do	do	500	do
do	Municipal	Montague	7,956	do
do	do	S. Deerfield	1,800	do
do	do	Northampton	29,000	do
do	do	Easthampton	200	do
do	do	South Hadley	6,860	do
do	do	Holyoke	53,750	do
do	do	Chicopee	41,950	do
do	do	West Springfield	8,000	do
do	do	Agawam	5,705	do
do	do	Longmeadow	5,790	do
Millers River	do	Athol	7,000	do
do	do	Erving	650	do
Otter River	do	Gardiner	20,000	Add to existing plant
Deerfield River	do	Deerfield	1,160	New plant
Manhan River	do	Easthampton	10,315	Replace existing plant
Mill River	do	Leeds	200	New plant
do	do	Williamsburg	100	do
Lampson Brk.	School	Belchertown	1,600	Add to existing plant
Stoney Brook	Municipal	S. Hadley	500	New plant
Chicopee River	do	N. Wilbraham	100	do
do	do	W. Wilbraham	200	do
do	Air field	Westover Field	2,000	Add to existing plant
Quaboag River	Municipal	Brookfield	50	New plant
do	do	W. Brookfield	50	do
do	do	Warren	100	do
do	do	W. Warren	50	do
do	do	Palmer	500	do
E. Brookfield River	do	Spencer	6,000	Add to existing plant
Chicopee Brook	do	Monson	200	New plant
Ware River	do	South Barre	75	do
do	do	Wheelwright	100	do
do	do	Gilbertville	400	do
do	do	Thorndike	800	do
do	do	Three Rivers	1,200	do
Prince River	do	Barre	1,000	do
Swift River	do	Bondsville	1,000	do
Westfield River	do	Huntington	1,000	do
do	do	Russell	1,000	do
do	do	Westfield	18,790	do

See footnotes at end of table.

Table I_4. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project[1] requirements
Westfield River	Municipal	W. Springfield	9,140	New plant
do	do	Agawam	1,500	do
MASSACHUSETTS INDUSTRY WITH SANITARY SEWAGE ONLY				
Connecticut River	Wood products	Erving	150	New plant
Quaboag River	Pump co.	Warren	200	do
Chicopee Brook	Weaving mill	Monson	425	do
Westfield River	Grinding wheel mfg.	Chester	100	do
MASSACHUSETTS INDUSTRIES WITH INDUSTRIAL WASTES				
Connecticut River	Paper mfg.	Turner Falls	N	New plant
do	do	do	N	do
do	Food products co.	S. Deerfield	N	do
do	Paper mfg. co.	Northampton	N	do
do	do	S. Hadley	N	do
do	do	do	N	do
do	do	Holyoke	N	do
do	do	do	N	do
do	do	do	N	do
do	do	do	N	do
do	do	do	N	do
do	do	do	N	do
do	do	do	N	do
do	do	do	N	do
do	do	do	N	do
do	Rendering plant	Chicopee	N	do
do	Brewery	do	N	do
do	Slaughter house	do	N	do
Millers River	Paper mfg.	Erving	N	do
do	do	Millers Falls	N	do
do	Tool mfg. co.	do	N	do
Deerfield River	Paper mfg. co.	Monroe	N	do
North River	do	Colrain	N	do
Manhan River	Thread co.	Easthampton	N	do
do	Cotton textile	do	N	do
do	Rubber thread	do	N	do
do	Felt co.	do	N	do
do	Elastic fabric	do	N	do
Bachelor Brk.	Paper mill	S. Hadley	N	do
Stoney Brook	do	do	N	do
Chicopee River	Plastic co.	Wilbraham	N	do
do	Wire and rod mill	do	N	do
do	Textile mills	Springfield	N	do
do	Chemical co.	do	N	do
do	Resin mfg.	do	N	do
do	Fire arms mfg.	Chicopee Falls	N	do
do	Rubber co.	do	N	do
Quaboag River	Coated paper co.	Brookfield	N	do
do	Fabric co.	West Warren	N	do
do	Dyeing and finishing	do	N	do
do	Textile mill	do	N	do
do	Wire co.	Palmer	N	do
do	Textile co.	West Warren	N	do

See footnotes at end of table.

Table I$_4$. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project[1] requirements
Ware River	Wool scouring	S. Barre	N	Add to existing plant
do	Paper co.	Wheelwright	N	New plant
do	Textile mill	Ware	N	do
Prince River	Machine shop	Barre	N	do
Swift River	Textile printing	Bondsville	N	do
Westfield River	Paper co.	Bancroft	N	do
do	Textile mill	Huntington	N	do
do	Rubber-textile mill	Russell	N	do
do	Paper mill	do	N	do
do	do	W. Springfield	N	do
do	do	do	N	do
Little River	do	Westfield	N	do
do	Thread mill	do	N	do
do	Textile machines	do	N	do
do	Bicycle mfg.	do	N	do
NEW HAMPSHIRE MUNICIPALITIES				
Connecticut River	Municipal	Northumberland	100	New plant
do	do	West Lebanon	1,000	do
do	do	Charlestown	700	do
do	do	North Walpole	200	do
do	do	Walpole	900	do
Mohawk River	do	Colebrook	1,600	do
Upper Ammonoosuc	do	Groveton	1,400	do
Israel River	do	Lancaster	2,100	do
Johns River	do	Whitefield	1,600	do
Ammonoosuc River	Hotels and cabins	Carroll	2,500	do
do	Municipal	Bethlehem	5,000	do
do	do	Littleton	3,000	do
do	do	Lisbon	1,500	do
do	do	Woodsville	3,000	do
Girl Brook	do	Hanover	1,500	do
Mink Brook	do	do	3,000	do
Mascoma River	do	Lebanon	5,500	do
Sugar River	do	Sunapee	500	do
do	do	Newport	5,000	do
Ashuelot River	do	Keene	15,000	Enlarge existing plant
do	do	West Swanzey	1,000	New plant
do	do	Winchester	1,000	do
do	do	Hinsdale	1,400	do
do	do	Marlboro	500	do
do	do	Troy	800	do
VERMONT MUNICIPALITIES				
Passumpsic River	Municipal	St. Johnsbury	7,250	New plant
VERMONT INDUSTRIES WITH INDUSTRIAL WASTES				
Moose River	Casein mfg.	Concord	N	Enlarge existing plant
Sleepers River	Creamery	St. Johnsbury	N	New plant

See footnotes at end of table.

Table I_4. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project[1] requirements
Wells River	Milk plant	S. Ryegate	N	New plant
do	Paper co.	Wells River	N	do
White River	Sawmill	Granville	N	do
do	Woolen co.	Hartford	N	do
Tweed River	Sawmill	Stockbridge	N	do
Broud Brook	Sawmill	Plymouth	N	do
Ottauquechee River	Woolen mill	Bridgewater	N	do
Mill Brook	Sawmill	Brownsville	N	do
Jewell Brook	Woolen co.	Ludlow	N	do
Black River	Woolen co.	Smithville	N	do
do	do	Cavendish	N	do
do	Textile mill	Springfield	N	do
Branch Brook	Cheese factory	Healdville	N	do
West River	Sawmill	Londonderry	N	do
Whetstone Brook	do	W. Wardsboro	N	do
do	do	Wardsboro	N	do
Rock River	do	E. Dover	N	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = information not available or does not apply.

[1] Projects at saw mills do not require construction of new waste treatment plants but rather projects for removal of existing sawdust piles and/or installation of sawdust collection and conveying equipment to prevent access of this material to streams.

THAMES RIVER SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Thames River Sub-Basin drains the eastern one-third of Connecticut, extends north into Massachusetts and east into Rhode Island. The sub-basin comprises an area of 1,473 square miles, of which 1,159 are in Connecticut, 253 in Massachusetts and 61 in Rhode Island. The general topography is hilly with elevations of 600 to 1,200 feet along the margins of the sub-basin. There are many swamps, mill ponds, lakes and reservoirs. Rock formation is predominantly granite with a glacial overburden of light sand and gravel. In certain areas the soil layer is reasonably heavy and fertile.

The average annual precipitation is about 44 inches, ranging from 43 inches in the northern part to 46 at the southwestern rim. There are 14 stream gaging stations in the sub-basin and over the years of record the total annual run-off has averaged about 2,500 cubic feet per second.

Economic Development

The soil in the Thames River Sub-Basin is not well suited to agriculture. Farming is generally on a small scale, nearly half the farms ranging in size from 3 to 69 acres. Livestock and livestock products account for nearly 90 percent of the farm income which, for all products sold, was estimated to be $30,000,000 in 1945.

Industry is the principal source of income for the residents of the sub-basin. The original development to an industrial economy was a result of the expansion of the cotton textile industry. There was a general collapse in this industry during the period 1920-39. Since that time manufacturing has become more diversified and the general economy of the region more stabilized. The textile industry still leads in manufacturing in the sub-basin but has been joined by industries engaged in manufacturing metal products, electrical equipment, hardware, paperboard, foodstuffs, etc. There are an estimated 425 manufacturing plants that employed an average of 43,000 persons during the year 1947. The total payroll for all manufacturing employees during that year was approximately $113,000,000 and the value added to products by manufacture was some $192,000,000.

Recreational facilities have not been developed to a very high degree except along the shore areas of Long Island Sound. There are more than 40,000 acres of land in State parks and forests that have been developed for at least one recreational activity. As an industry, recreation is relatively unimportant in the Thames Sub-Basin although the area has all the natural advantages required for water recreation development.

The 1950 population of the sub-basin is estimated to be 251,800. There are 11 urban cities and towns, the largest of which is New London with a 1950 population estimated to be slightly more than 33,000.

Uses of the Water Resources

All of the normal uses are made of the water resources of the Thames River Sub-Basin. Public water supply is the most important use and all surface supplies are developed on watersheds protected from pollution. Industrial water supply is the most economically important use and the original industrial development was a result of the quantity and quality of the waters available. The water resources are used extensively for all types of recreation and other important uses are for livestock watering, wildlife habitat, transportation of wastes and navigation. In the tidal section of the Thames River, the waters are used to a minor extent for shellfish propagation and commercial fishing operations.

POLLUTION DATA

Damages to Water Resources from Pollution

Damages to the water resources from pollution have been extensive. In Massachusetts, below the industrial cities of Webster and Southbridge, the main stems of the French and Quinebaug Rivers are in a nuisance condition during critical periods. For a distance below each of the industrial communities in Connecticut, the streams are only suitable for transportation of wastes and power development. These conditions also exist below isolated industries located on small streams. Most of the main stems of the principal tributaries are never suitable for recreational bathing or any higher use.

Sources of Municipal and Industrial Pollution

Tables A_5 and B_5 include data on sources of pollution in the Thames River Sub-Basin.

All of the sources of pollution have been determined and total 170. A total of nearly 154,000 persons contribute to 85 sources of sewage pollution from municipalities, institutions and manufacturing plants. There are 85 sources of industrial pollution discharging wastes directly to watercourses, principally from textile and paper mills.

Existing Municipal and Industrial Treatment Facilities

The existing treatment facilities are summarized in Tables C_5 and D_5. Twenty-two sources of sewage pollution, having a total contributing population of 69,300, are treated at 21 sewage treatment plants. New London has a new sewage treatment plant, but only half the population is served because additional intercepting sewers need to be constructed. Norwich has a satisfactory treatment plant for 4,100 persons but no facilities for treating the sewage from the remaining 20,000 sewered population. There are no sewage treatment facilities at 66 sources contributed to by a total of 84,400 persons including 9,900 employees in 51 industrial plants. Four manufacturing plants which treat employee sewage discharge industrial wastes untreated, but these figures do not appear in the tables.

Industrial waste treatment facilities have been constructed at 14 sources of industrial pollution, and 71 sources of such pollution are discharged without treatment.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

The adequacy of existing treatment facilities is summarized in Table E_5. Seventeen of the 21 sewage treatment works are satisfactory and four are not because of design or overloading. Half of the 14 industrial waste treatment plants are producing satisfactory effluents while six are not because of design or overloading. The status of one industrial waste treatment plant has not been determined.

Table F_5 shows progress in construction of treatment works to abate pollution in the Thames River Sub-Basin during the period 1946 through June 1950. From 1948 to July 1950 three industrial waste treatment plants were placed in operation, two treating organic wastes equivalent to the domestic sewage from a total of 7,500 persons and one treating metal plating wastes not calculable in ordinary terms of pollution measurement. One sewage treatment plant to serve 4,000 persons was completed in 1949, and another to serve 6,000 persons was placed in operation early in 1950.

Table G_5 lists the requirements for sewage and industrial waste treatment facilities. Sixty-four new sewage treatment plants are needed to treat the sewage from 84,300 persons residing in communities or employed in manufacturing plants. Two municipal sewage works serving 5500 persons require additions or enlargements to existing facilities. Two other municipal sewage plants require replacement with new plants to satisfactorily serve 13,100 persons. No project is required at 19 sources of sewage pollution that have been provided with treatment facilities adequate to serve a total of nearly 51,000 persons.

Sixty-nine sources of industrial waste pollution require construction of new treatment or disposal facilities. Six existing waste treatment plants need additions or enlargements before treatment will be adequate. No project is required at eight sources of industrial waste pollution that are now served adequately by existing treatment or disposal facilities. The status of requirements at two sources of industrial pollution has not been determined.

The status of treatment works projects to abate pollution is given in Table H_5. No formal

Table A_5. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	73[1]	66,540	42,654
Having population data available (Data on pollution load to watercourse incomplete or not available)	12[2]	87,200	Not applicable
Total	85	153,740	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] Includes 51 industries having sanitary sewage only from 11,412 employees.

[2] Includes 2 industries having sanitary sewage only from 200 employees.

action has been taken to require abatement projects at 58 sources of municipal and industrial sewage pollution. Two municipalities have been ordered to provide sewage treatment facilities and two others have plans for such works under preparation. Four sources of sewage pollution have plans approved for treatment works, one sewage treatment project is awaiting financing, and one sewage treatment plant is under construction.

No formal action has been taken to require construction of 74 needed industrial waste treatment projects. One industry has plans for an industrial waste treatment plant in preparation and the status of projects to abate pollution at two manufacturing plants is undetermined.

Table B_5. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	29	217,413
Producing organic wastes	43	Undetermined
Producing inorganic wastes	13	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	85	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Municipalities and Industries Requiring Improvements to Abate Pollution

A list of the sources of pollution requiring improvements to abate pollution has been compiled in Table I_5. The names of manufacturing establishments have been omitted to comply with the policies or laws of several of the New England States.

Table C_5.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	15[1] [2]	14[5]	48,700
Secondary	7[3]	7	20,610
No treatment	66[4]	0	84,430

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] Three municipalities give primary treatment to part of sewage. They are also included under no treatment.

[2] Includes one industry with sanitary sewage only from 1700 employees.

[3] One industry with sanitary sewage from 10 employees.

[4] Includes 51 industries with sanitary sewage only from 9902 employees.

[5] One treatment plant serves two housing developments.

Table D_5. Existing waste treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products..	3	0	3	0
Textile mill products......	52	5	47	0
Lumber and wood products...	0	0	0	0
Paper and allied products..	8	3	5	0
Chemical and allied products..........................	3	0	3	0
Products of petroleum and coal.......................	0	0	0	0
Rubber products............	0	0	0	0
Leather and leather products..........................	3	1	2	0
Primary metal industries...	0	0	0	0
Fabricated metal products..	9	2	7	0
Miscellaneous..............	7	3	4	0
Total....................	85	14	71	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_5. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	21	17	4	0	18	3	0
Industrial	14	7	6	1	10	4	0

Table F_5. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	0	--	0	--
1948	0	--	1	1,500
1949	1	4,000	1	Plating wastes
To July 1950	1	6,000	1	6,000

Table G_5. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	64[1,2,3,4]	84,332	69
Enlargement or additions to existing	2	5,500	6
Replace existing plant	2	13,100	0
No project required	19[5,6,7]	50,808	8[8]
Undetermined	0	0	2[9]

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] Includes one municipality requiring a new plant to serve part of the city and replacement for an old plant now serving another part of the city. Also listed under "Replace Existing Plant."

[2] Includes one municipality requiring a new plant to serve one part of the city and having a satisfactory sewage treatment plant for the rest of the city. Also listed under "No Projects Required."

[3] Includes one city requiring extension of interceptors to areas now discharging sewage to river. Remainder of sewage is adequately treated in present plant. Also listed under "No Projects Required."

[4] Includes 51 industries having sanitary sewage only from 9702 employees.

[5] Includes two towns which will abate pollution by requiring adequate private disposal.

[6] Includes two industries with sanitary sewage only from 1710 employees.

[7] One adequate treatment plant serves two housing projects.

[8] One industry disposes of its wastes satisfactorily by dilution.

[9] The requirements for one industry with no treatment are undetermined.

Table H_5. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	58[1]	74
Abatement ordered	2	0
Plans under preparation	2	1
Final plans approved	4	0
Construction awaiting financing	1	0
Under construction	1	0
Status undetermined	0	2

[1] Includes one municipality having two projects. The present plant serving part of the city is inadequate. Plans are being prepared for a new treatment plant to serve the rest of the city. Also listed under "Plans Under Preparation."

Table I5. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		CONNECTICUT MUNICIPALITIES		
Thames River	Municipal	Norwich	20,000	New plant
do	do	New London	12,000	New intercepters
do	do	Groton	4,000	New plant
do	do	do	900	Replace existing plant
Shetucket River	do	Taftville	2,000	New plant
Williamantic River	do	Stafford Springs	4,000	Add to existing plant
do	do	Willimantic	12,000	New plant
Quinebaug River	do	Danielson	3,000	do
do	do	Jewett City	4,000	do
Moosup River	do	Moosup	400	do
		CONNECTICUT INDUSTRIES WITH SANITARY SEWAGE ONLY		
Thames River	Yarn	Norwich	25	New plant
do	Plastics	do	15	do
do	Paper drapes	do	100	do
Shetucket River	Cartons	do	125	do
do	Drapes (2 plants)	do	69	do (2)
do	Woodworking	do	5	do
do	do	do	9	do
Thames River	Shoes	do	270	do
do	Thermos bottles	do	1,050	do
do	Oil	do	15	do
do	Lumber	do	24	do
do	Oil	do	4	do
do	Oil	do	3	do
do	Oil distribution	do	60	do
do	do	do	35	do
do	do	do	75	do
do	Cords and ribbons	do	40	do
Oxoboxo	Cotton insulation	Oakdale	10	do
do	Warehouse	Uncasville	75	do
do	Textiles	do	145	do
Shetucket River	Cotton weaving	Baltic	500	do
do	Textiles	Taftville	1,500	do
Mill Brook	Novelty yarns	South Coventry	25	do
do	do	do	35	do
Quinebaug River	Woolens	Fabyan	60	do
do	House heaters	Putnam	160	do
do	Electric controllers	Brooklyn	250	do
do	Combed cottons	Wauregan	515	do
do	Mill	Jewett City	N	do
French River	Cotton weaving	N. Grosvenordale	1,100	do
do	do	Grosvenordale	485	do
Five Mile River	Cotton goods	Ballouville	110	do
do	do	Attawaugan	285	do
do	do	Danielson	N	do
do	Worsteds	do	150	do
Whetstone Brook	Nylon products	Elmville	100	do
Moosup River	Oil burners	Moosup	15	do
do	Cotton yarns	do	150	do

See footnotes at end of table.

Table I_5. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
Moosup River	Worsted yarns	Moosup	200	New plant
do	Printing	do	5	do
do	Worsteds	Central Village	350	do
Pachaug River	Cables	Jewett City	325	do
do	Rayon fabrics	do	800	do
do	Bedroom furniture	do	50	do
CONNECTICUT INDUSTRIES WITH INDUSTRIAL WASTES				
Thames River	Awning cloth	Norwich	148	New plant
do	Tanning	do	2,945	do
Shetucket River	Photo processes	do	68	do
do	Tanning	do	567	do
do	Cotton finishing	do	40,300	do
Thames River	Wool dyeing	do	17,120	do
do	do	do	707	do
do	Paperboard	Uncasville	30,910	do
do	Laundry	Trading Cove	N	Add to existing plant
do	Chemical	do	N	New plant
do	Bottling cherries	New London	N	do
do	Plating	Groton	20[1]	do
Oxoboxo Bk.	Paperboard	Oakdale	2,570	do
do	do	Montville	13,900	Add to existing plant
do	Laundry	do	N	do
do	Sand washing	Uncasville	None[4]	New plant
Hall Brook	Wool dyeing	Hallville	N	do
Yantic River	do	Yantic	N	do
do	do	Norwichtown	N	do
do	do	do	N	do
do	Dairy	do	N	do
Shetucket River	Wool dyeing	Baltic	N	do
do	Cotton hand printing	Occum	130	do
do	Laundry	Taftville	N	do
do	Plastic fibre	do	N	Add to existing plant
do	Thermos bottles	do	N[1]	New plant
Little River	Wool dyeing	Hanover	1,760	do
do	Cotton gauze	Versailles	1,600	do
Sawmill Bk.	Cotton finishing	Conantville	N	do
Willimantic River	Cotton thread	S. Willington	N	do
do	Fibre board	Eagleville	2,112	do
do	Cotton thread	Willimantic	N	do
Furnace Bk.	Felt washing	Staffardville	N	do
do	Wool dyeing	Hydeville	N	do
do	Pearl buttons	Staffordville	N[3]	do
do	Wool dyeing	Stafford	N	do
Mill Brook	Fish line	South Coventry	N	do
Quinebaug River	Wool dyeing	Putnam	N	do
do	Silk thread	do	N	do
do	Silk and nylon	do	N[2]	do
do	Phonograph needles	do	N[1]	do

See footnotes at end of table.

Table I5. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
Quinebaug River	Paperboard	Goodyear	4,768	Add to existing plant
do	Macaroni	Danielson	N	New plant
do	Cotton finishing	Jewett City	N	do
French River	Plating	Wilsonville	N[1]	do
do	Wool dyeing	do	N	do
do	Cotton printing	Mechanicsville	N	do
do	Cotton and rayon finishing	do	N	do
Five Mile River	Pins	Dayville	N[1]	do
do	Cotton finishing	Danielson	N	do
Whetstone Bk.	Cotton gauze	E. Killingly	N	do
do	Wool dyeing	do	N	do
Moosup River	Fibre board	Oneco	336	do
do	Silk finishing	Sterling	N	do
do	Wool dyeing	Moosup	N	do
do	Wool scouring	do	N	do
do	Plating	do	N[1]	do
do	Rayon dyeing	Central Village	N	do
Horse Bk.	Cotton hand printing	Plainfield	N	do
Pachaug River	Cotton finishing	Voluntown	N	Add to existing plant
do	Cotton kiering and finishing	Glasgo	N	New plant
MASSACHUSETTS MUNICIPALITIES				
Quinebaug River	Municipal	Fiskdale	600	New plant
do	do	Southbridge	12,200	Replace existing plant
French River	do	Leicester	1,500	Add to existing plant
do	do	Rochdale	350	New plant
do	do	Oxford	80	do
do	do	Webster	13,000	do
do	do	Dudley	3,000	do
MASSACHUSETTS INDUSTRIES WITH SANITARY SEWAGE ONLY				
French River	Hosiery	Rochdale	250	New plant
do	Cordage	N. Oxford	25	do
do	Textile	do	39	do
do	Garnetting	do	22	do
do	Textile	do	15	do
Little River	Garnetting	Oxford	28	do
MASSACHUSETTS INDUSTRIES WITH INDUSTRIAL WASTES				
Quinebaug River	Tool manufacturing	Fiskdale	N[2]	New plant
do	Wool dyeing	Southbridge	9,600	do
do	Lens grinding	do	1,220[3]	do
do	Cotton finishing	do	13,200	do
do	Paper	W. Dudley	27,400	do
Cady Brook	Wool dyeing	Charlton City	1,610	do
do	do	do	262	do

See footnotes at end of table.

Table I_3. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
French River	Wool dyeing	Rochdale	N	New plant
do	do	N. Oxford	N	do
do	Wool finishing	Hodges Village	400	do
do	do	Webster	N	do
do	do	do	N	do
do	Linen processing	Dudley	2,500	do
Mill Brook	Cotton finishing	Webster	25,000	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N=Information not available or does not apply.

[1] Plating.

[2] Oils.

[3] Grinding compounds.

[4] Sand washing.

[5] Rouge abrasives.

PAWCATUCK RIVER SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Pawcatuck River drains a small part of southeastern Connecticut and about one-fourth of southwestern Rhode Island. The river is some 20 miles in length and the last 10 miles of its course form the boundary line between these two States. The Pawcatuck River drains an area of 295 square miles of which 233 are in Rhode Island.

The course of the river is through rolling country except at the coastal plain and the sub-basin contains a number of swamps and ponds. The rock formation is chiefly granite with an overburden of glacial sand and gravel. There are occasional outcroppings of granite. About one-fourth of the sub-basin is in farmland and the northern portions of the sub-basin are mainly in second-growth hardwood cover.

Rainfall averages about 44 inches per year. Summer temperatures average about 67°F. and winter temperature averages vary from 30° to 32° F. Three stream gaging stations are maintained and the records indicate the average annual run-off to be about 575 cubic feet per second.

Economic Development

The fertility of the land is considerably below the average for Connecticut. The livestock and truck gardening are the principal agricultural pursuits and the sale of dairy and poultry products account for nearly 90 percent of farm revenue. The value of all farm products sold in 1945 was estimated to be about $4,000,000.

Industry is the main source of income in the sub-basin. Textile manufacturing activities account for most of the employment. There are an estimated 65 manufacturing establishments in the sub-basin that employ approximately 6,000 persons. The total salaries and wages paid these employees in 1947 was an estimated $16,000,000. The value added to products by manufacture during that year was approximately $24,000,000.

The Pawcatuck River enters Block Island Sound in an area that has been highly developed for recreational purposes. In this area a large amount of private capital has been invested in bathing beaches, yacht clubs, summer homes and hotels. There are several State parks and forests in the interior regions of the sub-basin that have been developed for some recreational uses.

The 1950 population of the sub-basin is estimated to be 36,000. Westerly, R. I., is the only urban area within the sub-basin, although the Connecticut portion of the sub-basin is in urban Stonington town. The population of Westerly town in 1950 is estimated to be some 12,000.

Uses of Water Resources

Extensive use is made of the surface water resources of this sub-basin for all legitimate purposes. Water supplies are derived principally from driven wells. The most economically important use of the waters is for industrial water supply. The most extensive use is in all types of recreational activity. Other important uses are for shellfish propagation, commercial fishing, wildlife habitat and navigation.

POLLUTION DATA

Damages to Water Resources from Pollution

The Pawcatuck River from Pawcatuck to Little Narragansett Bay is damaged by pollution so as to be unsuitable for use in recreational bathing and the taking of shellfish. In Rhode Island some sections of the Pawcatuck River are damaged by pollution from Worden Pond to the State Line and are considered unsatisfactory for game fishing, recreational bathing and the taking of shellfish. Above Worden Pond, White Horn Brook for a distance is unsuitable for game fishing and some recreational uses.

The Chipuxet and Queen Rivers are undamaged by pollution but the Wood River is unsuitable for recreational bathing. The Ashaway River has also been damaged for use in recreational bathing and for game fishing as well.

Sources of Municipal and Industrial Pollution

Data on sources of pollution are contained in Tables A_6 and B_6. There is a total of 35 sources of pollution, 22 are sewage pollution sources with a contributing population of 16,460 persons and 13 are industrial sources discharging wastes directly to watercourses. Industrial wastes originate almost wholly from the processing of cotton and woolen textiles.

Existing Municipal and Industrial Treatment Facilities

Of the total of 35 sources of pollution in the sub-basin, five sources of sewage pollution from a total contributing population of 14,600 provide treatment in six plants. One source of industrial waste is treated before discharge. Twenty-nine sources of pollution are discharged without treatment, 17 of these are sources of sewage pollution with a contributing population of 1,800 persons and 12 as sources of industrial wastes. These and other data are included in Tables C_6 and D_6.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Table E_6 shows the adequacy of existing treatment facilities. Only one of the seven existing waste treatment works is providing satisfactory treatment. Five of the sewage treatment plants are unsatisfactory in capacity as is the one industrial waste treatment facility.

Table A_6. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	20[1]	12,463	7,264
Having population data available (Data on pollution load to watercourse incomplete or not available)	2	4,000	Not applicable
Total	22	16,463	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] Includes 7 industries having only sanitary sewage from 1693 employees and 11 small communities with a tributary population of 370.

During the period 1946 through June 1950, one sewage treatment plant to serve 10,000 persons was completed. No other progress in construction of waste treatment works projects to abate pollution were completed during this period as shown by Table F_6.

Tables G_6 and H_6 show the requirements for and status of treatment works projects. Fifteen sources of sewage and industrial waste pollution require new plants, four require enlargement or additions to existing plants, two existing sewage plants require replacement, 12 sources of sewage pollution require no municipal construction projects but require satisfactory disposal by individual treatment methods. The status of three sources of industrial waste pollution is undetermined. This is a total of 21 sources of pollution requiring improvements to abate pollution. No formal action to abate pollution has been taken on 20 of these sources and one source of sewage pollution has plans under preparation for treatment facilities.

Municipalities and Industries Requiring Improvements to Abate Pollution

A list of the sources of pollution requiring improvements is given in Table I_6. The names of manufacturing plants have been omitted in accordance with the policies or laws of several of the New England States.

Table B_6. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	0
Producing organic wastes	11	Undetermined
Producing inorganic wastes	2	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	13	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_6.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	3	4[3]	10,635
Secondary	2[1]	2	4,000
No treatment	17[2]	0	1,828

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] Includes one industry having sanitary sewage only from 235 employees.

[2] Includes six industries having sanitary sewage only from 1458 employees.

[3] One municipality served by two treatment plants.

Table D_6. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products	0	--	--	--
Textile mill products	10	0	10	0
Lumber and wood products	0	--	--	--
Paper and allied products	0	--	--	--
Chemical and allied products	0	--	--	--
Products of petroleum and coal	1	0	1	0
Rubber products	0	--	--	--
Leather and leather products	0	--	--	--
Primary metal industries	0	--	--	--
Fabricated metal products	1	0	1	0
Miscellaneous	1	1	0	0
Total	13	1	12	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_6. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	6	1	5	0	4	2	0
Industrial	1	0	1	0	0	1	0

Table F_6. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	0	--	0	--
1948	0	--	0	--
1949	1	10,000	0	--
To July 1950	0	--	0	--

Table G_6. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	6	1,458	9
Enlargement or additions to existing plant	3	4,235	1
Replace existing plant	2[1]	400	0
No project required	12[2]	10,370	0
Undetermined	0	0	3

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] One municipality must replace two plants.

[2] Includes 11 small communities with total tributary population of 370 where pollution will be abated by satisfactory individual treatment.

Table H_6. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	10	10
Abatement ordered	0	0
Plans under preparation	1	0
Final plans approved	0	0
Construction awaiting financing	0	0
Under construction	0	0
Status undetermined	0	3

Table I_6. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
CONNECTICUT INDUSTRIES WITH SANITARY SEWAGE ONLY				
Pawcatuck River	Textiles sales	Pawcatuck	12	New plant
do	Printing presses	do	1050	do
do	Cotton cloth	do	9	do
do	Wood products	do	17	do
do	Satin and rayon	do	170	do
do	Corsets	do	200	do
CONNECTICUT INDUSTRIES WITH INDUSTRIAL WASTES				
Pawcatuck River	Cotton waste	Pawcatuck	N	New plant
do	Laundry	do	N	Add to existing plant
do	Stapling machine mfg.	do	N	New plant
RHODE ISLAND MUNICIPALITIES				
Pawcatuck River	Municipal	Bradford	400	Replace existing plants (2)
White Horn Brook	Institutional	R. I. State College	3000	Add to existing plant
Queen River	do	Exeter State Hospital	1000	do
RHODE ISLAND INDUSTRY WITH SANITARY SEWAGE ONLY				
Pawcatuck River	Braid	Shannock	235	Add to existing plant
RHODE ISLAND INDUSTRIES WITH INDUSTRIAL WASTES				
Pawcatuck River	Textile	Kenyon	N	New plant
do	do	Bradford	N	do
do	Woolens	Potter Hill	N	do
do	Textile	White Rock	N	do
Wood River	do	Hope Valley	N	do
do	do	Alton	N	do
Ashaway River	do	Ashaway	N	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = information not available or does not apply.

NARRAGANSETT BAY SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Narragansett Bay Drainage Sub-Basin comprises almost the whole of the State of Rhode Island and about 890 square miles of southeastern Masschusetts. The total drainage area of this sub-basin is 1,700 square miles. The largest river emptying into Narragansett Bay is the Blackstone, being about 31 miles long and draining an area of 540 square miles. The Taunton River is about 50 miles long with a watershed of 516 square miles. The only other river of any size is the Pawtuxet with a drainage area of 232 square miles. There are several other smaller streams that empty into the tidewaters of Narragansett Bay.

The terrain of the Blackstone River Sub-Basin is generally rolling while in all the other areas of the Narragansett sub-basin it is typically coastal lowland containing numerous swamps and poorly drained low areas. The principal rock formation is granite with other igneous rocks and covered with a glacial deposit of sand and gravel. The topsoil is sandy and not suited to general farming. About 30 percent of the sub-basin is in cleared farmland and the remainder is in woodland, swamps, and urban developments.

The average annual precipitation is about 45 inches, varying in different parts of the sub-basin from 43 to 48 inches. Rainfall is fairly evenly distributed through the year. Winter temperature averages vary from 28° to 32°F. and summer temperature averages vary from 66° to 69°F. There are 12 gaging stations within the sub-basin and records available indicate an average annual run-off of 1.7 second feet per square mile or a total of 2,890 cubic feet per second for the sub-basin.

Economic Development

Industry is by far the principal source of income in the Narragansett Bay Sub-Basin. This region is one of the most highly developed manufacturing areas in New England. The original intense industrial development was by the textile industry and, although it has declined somewhat, it is still the leading manufacturing activity and includes the manufacture of textile machinery. Industry is becoming more diversified and the manufacture and processing of foods, chemicals, leather, paper, etc., are other prominent industries at present. There are an estimated 2,910 manufacturing establishments in the sub-basin that employed an average of 197,000 persons during 1947. The total wages paid all manufacturing employees during that year was some $518,000,000, and the value added to products by manufacture was approximately $885,000,000.

The soil in the sub-basin is sandy and, while not suited to general farming, is intensively cultivated in truck garden products and large numbers of livestock and poultry are raised. Dairy and poultry products account for more than half of the farm revenue. The value of all farm products sold in the sub-basin in 1945 was an estimated $16,500,000.

Recreation as an industry is not well developed within the sub-basin except to serve its own population. Competition from the famous Cape Cod area nearby has had a retarding effect on commercial recreational development. Nevertheless, recreational use of the waters is important and very popular with the residents of the region.

The 1950 population of the Narragansett Bay Sub-Basin is estimated to be 1,030,000. The area includes most of Rhode Island which is the most densely populated State in the country. The largest city is Providence, with an estimated 1950 population of 278,000. Worcester, Mass., is the second largest city with a 1950 population of 201,875.

Uses of the Water Resources

In such a densely populated, highly industrialized area there is a very extensive use of the water resources for all normal purposes. All public surface water supplies are taken from protected watersheds, except East Providence which has its source in a polluted river. The most economically important use of the waters is for industrial water supply, of which huge volumes are used. Other extensive uses are for all types of water recreation activity, livestock watering, wildlife habitat, commercial fishing, shellfish operations, power development, navigation and transportation of wastes. The original industrial development and subsequent growth of the region was due to the quality and quantity of the water resources.

POLLUTION DATA

Damages to Water Resources from Pollution

Damages to the water resources from pollution have been extensive and every water use except navigation and power development has been damaged at some point in the sub-basin. There are 49 rivers, tributaries, lakes and tidal coves and harbors in the sub-basin that are subject to pollution. Only 12 of these bodies of water receiving pollution are undamaged. The most extensive damages have occurred to uses for all types of recreation and to shellfish operations. Damage to waters important for use in livestock watering, industrial water supply, wildlife habitat and irrigation has also been appreciable. Damages have been greatest to the principal rivers and their tributaries. Many of these streams transport sufficient pollution to degenerate into nuisance conditions during critical periods of low flow and high temperature.

Sources of Municipal and Industrial Pollution

A summary of the sources of sewage and industrial waste pollution will be found in Tables A_7 and B_7. That damages have been sustained by the water resources from pollution is demonstrated by the total of 209 separate sources of pollution discharging directly to watercourses. Seventy-seven sources of pollution, with a contributing population of 954,700 persons, originate from the discharge of sewage from communities, institutions and industries. One hundred thirty-two sources of pollution result from the direct discharge to watercourses of industrial wastes, principally organic in nature. Eighteen of these industrial sources of pollution contribute wastes known to be equivalent to the domestic sewage from 218,700 persons.

Existing Municipal and Industrial Treatment Facilities

Of the total of 209 sources of pollution only 53 receive treatment, there being 31 sewage treatment and 22 industrial waste treatment facilities. Nearly 90 percent of all the sewage receives some degree of treatment but it is estimated that less than 15 percent of all the industrial wastes are treated. These and other data are shown in Tables C_7 and D_7

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Table E summarizes the adequacy of existing treatment facilities. It will be noted that of the total of 53 existing waste treatment plants, only 23 are knows to be providing completely satisfactory degrees of treatment. Eleven sewage treatment and 10 industrial waste treatment facilities are inadequate in capacity and the status of 2 sewage and 7 industrial waste treatment works is undetermined.

Good progress in construction of treatment works projects to abate pollution is being made as shown in Table F_7. During the period 1946 through June 1950 a total of 14 industrial waste treatment plants were placed in operation. The amount of wastes being treated by these facilities is not available. During the same period, 10 sewage treatment works were completed and serve a total of 447,500 persons. Five of these plants were completed in 1949 and the remaining five before July 1950.

Table G_7 lists the requirements for sewage and industrial waste treatment plants. It is clearly shown that much construction is still needed. Thirty-seven new sewage and 97 new industrial waste treatment works are needed. Enlargements or additions to eight existing sewage and 9 existing industrial waste treatment plants are required. Three other existing sewage treatment plants and five other existing industrial waste treatment works are inadequate in design and capacity and require replacement with new facilities. No construction projects are needed for 20 existing sewage and six existing industrial waste treatment

Table A_7. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	56[1]	315,823	129,194
Having population data available (Data on pollution load to watercourse incomplete or not available)	21[2]	638,916	Not applicable
Total	77	954,739	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] Includes 21 industries having sanitary sewage from 3978 employees.

[2] Includes 6 industries having sanitary sewage from 15 employees; 5 of the industries have no data on employees.

plants that are now considered adequate. The status of nine sources of sewage and 15 sources of industrial waste pollution has not been determined and for which requirements are not known.

The status of treatment works projects to abate pollution in the Narragansett Bay Subbasin is summarized in Table H_7. Of the total of 159 sources where treatment work projects are known to be required action has been taken to abate pollution on 11. There has been no formal action taken as yet to require abatement projects at 43 sewage and 105 sources of industrial wastes pollution where construction is required or to determine the needs of 24 other sources of pollution, of which 9 are from sewage and 15 are from industrial waste discharges.

Table B_7. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	18[1]	218,682
Producing organic wastes	103	Undetermined
Producing inorganic wastes	13	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	132[2]	--

*Industries having separate outlets and discharging wastes directly to watercourse.

[1] Includes 2 industries also producing inorganic wastes and recorded in that category also.

[2] Adjusted in accordance with [1].

Municipalities and Industries Requiring Improvements to Abate Pollution

A list of the sources of pollution requiring improvements to abate pollution is given in Table I_7. The names of communities and institutions are given but the names of firms are excluded in compliance with the policies or laws of the States concerned with this subbasin.

Table C_7.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	11[1]	11	172,777
Secondary	20	20	682,755
No treatment	46[2]	0	99,207

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] Includes 2 industries having sanitary sewage only from 559 employees.

[2] Includes 25 industries having sanitary sewage only from 3,435 employees.

Table D_7. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products..	2	2	0	0
Textile mill products......	100	13	80	7
Lumber and wood products...	0	0	0	0
Paper and allied products..	2	0	0	2
Chemical and allied products......................	4	2	2	0
Products of petroleum and coal.......................	0	0	0	0
Rubber products............	4	0	2	2
Leather and leather products......................	3	2	1	0
Primary metal industries...	3	1	2	0
Fabricated metal products..	12	2	8	2
Miscellaneous..............	2	0	2	0
Total....................	132	22	97	13

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_7. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	31	18	11	2	23	3	5
Industrial	22	5	10	7	10	4	8

Table F_7. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	2	Data not available
1947	0	--	1	do
1948	0	--	3	do
1949	5	124,100	5	do
1950	5	323,400	3	do

Table G_7. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	37	98,306	97
Enlargement or additions to existing plant	8	212,377	9[2]
Replace existing plant	3	26,000	5[3]
No project required	20[1]	613,990	6[4]
Undetermined	9	4,066	15

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] Two industries having sanitary sewage only dispose of wastes by dilution; satisfactory for the present.

[2] Includes two treatment plants of undetermined status but known to require additions.

[3] Includes two treatment plants of undetermined status but known to require replacement by new works.

[4] One industry disposes of wastes by dilution, a satisfactory method for the present.

Table H_7. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	43	105
Abatement ordered	0	0
Plans under preparation	3	5
Final plans approved	0	0
Construction awaiting financing	1	0
Under construction	1	1
Status undetermined	9	15

Table I_7. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		MASSACHUSETTS MUNICIPALITIES		
Taunton River	Municipal	Taunton	37,400	Add interceptors
do	do	Fall River	100,000	do
Town River	do	Bridgewater	2,000	New plant
Nemasket River	do	Middleboro	6,000	do
Ten Mile River	do	Attleboro	12,000	Add to existing plant
Blackstone River	do	Millbury	1,000	New plant
do	do	Saundersville	1,000	do
do	do	Farnumsville	300	do
do	do	Uxbridge	2,500	do
do	do	Millville	500	do
do	do	Blackstone	1,000	do
Kettle Brook	do	Cherry Valley, Leicester	1,500	do
Quinsigamond River	do	Grafton Center	1,000	do
Axtell Brook	Institutional	Grafton	2,300	Add to existing plant
Mumford River	Municipal	Manchaug Village	1,000	New plant
do	do	N. Uxbridge	1,000	do
		MASSACHUSETTS INDUSTRY HAVING SANITARY SEWAGE ONLY		
Assonet River	Quilted textiles	Assonet	175	New plant
		MASSACHUSETTS INDUSTRIES HAVING INDUSTRIAL WASTES		
Taunton River	Shellac mfg.	Somerset	N	New plant
Three Mile River	Cotton finishing	Dighton	N	do
do	do	do	N	do
Wading River	Atomizer mfg.	Norton	N[1]	do
do	Laundry	do	N	do
do	Bleachery	do	N	do
Rumford River	Resins and chemicals	Mansfield	N	Enlarge existing plant
do	Wool scouring	Norton	9,000	Add to existing plant
Assonet River	Finish cotton goods	Assonet	N	New plant
Ten Mile River	Electro-plating	N. Attleboro	N[1]	Replace existing plant
do	Jewelry	do	N[1]	New plant
do	do	Attleboro	N[1]	do
do	do	do	N[1]	do
do	do	do	N[1]	do
do	do	do	N[1]	do
do	do	do	N[1]	Add to existing plant
Blackstone River	Wire	Worcester	N	New plant
do	Worsted mfg.	Farnumsville	N	do
do	Woolen mfg.	Uxbridge	N	do
do	Worsted mfg.	do	N	do
do	Woolen mfg.	do	N	do
do	Wool combing	Millville	N	do
Weasel Brook	Dairy	W. Boylston	10	Replace existing plant

See footnotes at end of table.

Table 17. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--Continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
Kettle Brook	Spinning and finishing	Cherry Valley	1,000	New plant
do	Woolen mfg.	do	500	do
do	Artificial leather mfg.	Worcester	N	do
do	Woolen mfg.	do	4,600	do
do	Combing co.	Auburn	2,400	do
Ramshorn Brk.	Wool scouring	W. Millbury	300	Add to existing plant
do	do	Millbury	N	New plant
Mumford River	Woolen mfg.	E. Douglas	N	do
do	do	do	N	do
West River	Millinery	W. Upton	N	do
do	Worsted mfg.	Uxbridge	N	do
		RHODE ISLAND MUNICIPALITIES		
Greenwich Cove	Municipal	E. Greenwich	2,000	Replace existing plant
Narragansett Bay	Naval	Melville	N	New plant
do	do	Lawtons	N	do
do	do	Newport	N	do
do	Municipal	do	25,000	do
Warren River	do	Barrington	N	do
Narragansett Bay	do	Jamestown	1,090	do
do	Naval	Gould Island	N	do
Providence River	Municipal	E. Providence	12,000	Replace existing plant
do	Recreational	Edgewood	300	New plant
do	do	Stillhouse Cove Bay	100	Add to existing plant
Moshassuck River	Municipal	Central Falls	12,000	Replace existing plant
Seekonk River	do	Pawtucket	50,600	New plant
Blackstone River	do	Woonsocket	60,000	Add to existing plant
		RHODE ISLAND INDUSTRIES HAVING SANITARY SEWAGE ONLY		
Woonasquatucket River	Weaving worsteds	Georgiaville	16	New plant
Blackstone River	Worsted yarns	Woonsocket	300	do
do	do	do	500	do
do	Knitting	do	175	do
do	Weave worsteds	do	475	do
Blackstone River	Public utility garage	Woonsocket	20	New plant
do	Weaving	do	100	do
do	Weave cotton	Albion	N	do
do	do	Berkeley	N	do
Branch River	Weaving worsteds	Glendale	130	do
do	do	Nasonville	75	do
do	do	do	175	do
do	Weaving Woolens	Branch Village	375	Add to existing plant
Pascoag River	Card spin and weave woolens	Pascoag	175	New plant
Clear River	Spin yarns	Bridgeton	25	do

See footnotes at end of table.

Table 17. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--Continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
Chepachet River	Weave worsteds	Chepachet	175	New plant
Stillwater River	do	Smithfield	202	Add to existing plant
RHODE ISLAND INDUSTRIES HAVING INDUSTRIAL WASTES				
Appanaug Cove	Cotton dyeing and finishing	Appanaug	N	New plant
Greenwich Cove	Nylon dyeing	Warwick	N	do
do	Woolen dyeing	do	N	do
Maskerchugg River	Bleaching cotton and rayon	E. Greenwich	N	do
Bristol Harbor	Wool scouring	Bristol	N	do
Woonasquatucket River	Cotton dyeing and finishing	Providence	N	do
do	Rubber goods	do	N	do
Stillwater River	Cotton dyeing and finishing	W. Greenfield	N	New plant
Moshassuck River	do	Saylesville	59,424	Add to existing plant
do	Woolen finishing	Pawtucket	23,040	New plant
Seekonk River	Cotton dyeing and finishing	do	3,924	do
do	Commission bleaching and dyeing	E. Providence	2,958	do
do	Bleaching and dyeing	Pawtucket	3,372	do
do	Cotton printing	E. Providence	17,880	do
do	Steel rolling mill	do	400[2]	do
do	Copper wire	do	150[3,7]	Replace existing plant
do	Felt and insulation board	do	68,880	New plant
Blackstone River	Shirting and dress goods	Blackstone	N	do
do	Plush mfg.	Woonsocket	N	do
do	Mohair plush mfg.	do	N	do
do	Woolen dyeing	do	N	do
do	Woolen top dyeing	do	N	do
do	Dyeing and finishing	do	N	do
do	Weave and finish worsteds	do	N	do
do	Finishing plush and velour	do	N	do
do	Dye worsted tops	do	N	do
do	Weave and dye worsteds	do	N	do
do	Spin weave worsteds	do	N	do
do	Rayon yarns	do	N	do
do	Dyeing silk and acetate	do	N	do
do	Scouring and dyeing	do	N	do
do	Rubber rolls	do	N	do
do	Wool scouring and weaving	do	N	do
do	do	do	N	do
do	do	do	N	do

See footnotes at end of table.

Table 17. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--Continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
Blackstone River	Wool weaving and dyeing	Woonsocket	N	New plant
do	Fiberglass yarn	Ashton	N	do
do	Cotton dyeing	Lonsdale	16,992	do
do	Dye and finish nets	do	N	do
do	Weave rayon	Valley Falls	N	do
do	Weave wash draperies	do	N	do
do	Rayon fabrics	S. Attleboro, Mass.	N	do
do	Textile machinery	do	N	do
do	Rayon dyeing	Central Falls	N	do
do	Commission dyeing	do	N	do
do	Bleach and dyeing rayon	do	N	do
	Bleach and dyeing cotton	Pawtucket	N	do
do	Bleach and dyeing cotton	do	N	do
do	do	do	N	do
do	Dyeing rayon yarns	do	N	do
do	Finishing knitted goods	do	N	do
Branch River	Worsted washing	Oakland	N	do
do	Washing yarns	Forestdale	N	do
do	Dyeing cottons	Slatersville	N	do
do	Dyeing woolens	Forestdale	N	do
do	Wool scouring	Branch Village	N	Replace existing plant
Pascoag River	Washing worsteds	Pascoag	N	New plant
do	Scouring cloth and top dyeing	Harrisville	N	do
do	Wool scouring	do	N	do
Clear River	Dyeing men's worsteds	Bridgeton	N	do
Mill River	Dyeing worsted yarns	Woonsocket	N	do
Peters River	Scouring men's suiting	do	N	do
Ten Mile River	Dyeing knit goods	Pawtucket	N	do
do	Dyeing yarns	do	N	Add to existing plant
do	Baking powder	E. Providence	3,852	do
Pawtuxet River	Metal working	Cranston	N[2]	New plant
North Branch Pawtuxet River	Laundry	Jackson	N	do
do	Cotton dyeing	Awkwright	N	Replace existing plant
do	Lace mfg.	Harris	N	Add to existing plant
do	Rayon mfg.	Lippitt	N	New plant
South Branch Pawtuxet River	Cotton dyeing	Centerville	N	do
do	Rayon weaving	River Point	N	do
do	Dyeing lace	do	N	do
do	Coating rayon yarns	do	N	do
do	Dyeing woolens	do	N	do
Pocasset River	Dyeing cottons	Cranston	N	do
Saugatuckett River	Wool scouring	Peacedale	N	Add to existing plant

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = Information not available or does not apply.

[1] Plating. [2] Pickling. [3] Oils. [4] Degreasing. [5] Acids. [6] Grinding compounds. [7] Copper.

MASSACHUSETTS COASTAL STREAMS SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Massachusetts Coastal Streams Sub-Basin includes almost 100 percent of the coastal shoreline of the Commonwealth. The streams drain all of the area fronting Massachusetts Bay on the east and Buzzards Bay on the south. The sub-basin has an ocean front of nearly 1,000 miles and extends inland a maximum distance of 30 miles along the Charles River, averaging some 10 to 20 miles elsewhere along the shoreline.

The terrain is typically coastal lowland with low undulating hills in the interior parts of the sub-basin. Much of the area is swampy or poorly drained land and watershed lines are not well defined. The rock formation is granite that outcrops at the surface in some areas. The bedrock is covered with glacial sand and gravel over which are deposits of sandy loams. About one-third of the sub-basin is classified as urban and the rural parts are mostly in farms. Nearly 50 percent of the sub-basin is in woodland that is of little commercial value.

There are about a dozen small streams draining the sub-basin that empty into the Atlantic Ocean. The principal streams are the Charles, Ipswich and Neponset Rivers of which the Charles is largest. The total drainage of all the coastal streams in this sub-basin is about 1,900 square miles.

Summer temperatures average about 68°F. and winter temperatures average about 28°F. with somewhat milder temperatures prevailing in the Cape Cod area. The average annual precipitation is about 42 inches, ranging from some 39 inches on Cape Cod to 47 inches near Boston. Discharge records kept on five of the coastal streams indicate that total run-off in the sub-basin annually averages about 2,800 cubic feet per second.

Economic Development

The area encompassed by this sub-basin, which represents about 30 percent of the total land area in Massachusetts, is the most heavily populated and highly industrialized area in New England. About one-half of the area and 95 percent of the population are in metropolitan districts. The 1950 population of the sub-basin is estimated at 3,000,000 and the area has shown a steady gain in population. Boston, with a 1950 population of 790,863 is the largest city in the sub-basin, and there are five others with populations of over 100,000. The 1950 census releases will probably show that there are more than 15 cities of 25,000 and over, and more than 20 cities with populations over 10,000.

Manufacturing is by far the principal economic activity in the sub-basin and the Boston metropolitan area is the most highly industrialized in New England. The New Bedford-Fall River area is another highly industrialized metropolitan district. In the past specialization in one industry by whole cities resulted in serious economic declines, but there is a growing diversification of manufacturing in all the metropolitan districts that is contributing to the general economic stability of the sub-basin. Almost all of the manufacturing fields are now represented in the sub-basin and, while not as important as in years past, the textile and leather products manufacturing fields are still prominent. There are an estimated 4,850 manufacturing plants in the sub-basin that employed approximately 250,000 persons in 1947. During that year the wages paid all manufacturing employees was over $640,000,000 and the value added to products by manufacture was some $1,200,000,000.

While farming in this sub-basin is on a small scale, it is intensely practiced. Because of the nearby urban markets, farming activities are principally in dairying, poultry raising, fruit growing and truck gardening. In the Cape Cod area cranberries are the principal source of farm income, and the region grows nearly two-thirds of the entire production of the United States. The value of all farm products sold in this sub-basin during the year 1945 is estimated at $35,000,000.

Commercial fishing is an important industry in the sub-basin and Boston is the principal fishing port in the United States. There was at one time very extensive shellfishing in this coastal sub-basin, but pollution has greatly decreased the value of this industry. It still remains, however, an industry of importance that would expand considerably if pollution were abated.

Almost the entire shoreline of this coastal sub-basin has been developed for recreational use by both private and public capital. It serves one of the most densely populated areas in the United States and thousands of vacationists from all over the country. The facilities are considerably crowded and the encroachment of pollution is further limiting the available opportunities for recreational use, particularly near the metropolitan population centers. Most of the inland waters transport too much pollution to be of much recreational value. The Cape Cod area is by far the best known recreational center in the sub-basin and here, as well as elsewhere in the region, there has been a tremendous investment in recreational real estate in the form of summer homes, resort hotels, amusement centers and yacht clubs.

Uses of Water Resources

There is almost every use made of the water resources in this highly populated and industrialized area. Public water supply is the most important, and use in all types of recreational activity undoubtedly ranks second. Extensive use is also made of the waters for industrial water supply, shellfish propagation, wildlife habitat, livestock watering, navigation, commercial fishing and transportation of wastes.

POLLUTION DATA

Damages to Water Resources from Pollution

Almost every water use except navigation has been damaged by pollution at some point in the sub-basin. Damage has been greatest to recreational uses, particularly bathing and game fishing. The Neponset and Charles Rivers transport the most pollution and are the most extensively damaged. Nuisance or near-nuisance conditions result in these streams or their tributaries during periods of critical low flows and high temperatures. The Ipswich River is unsuited for public water supply because of pollution transported by Lubber Brook. It is also damaged for use in livestock watering, game fishing, other recreational uses and shellfish operations. The shore areas off the northern end of Plum Island are unsuitable for bathing and the taking of shellfish. The Aberjona River is not satisfactory for bathing.

Sources of Municipal and Industrial Pollution

Data on sources of pollution are summarized in Tables A_8 and B_8 . It will be noted that the principal pollution results from the discharge of sewage by 67 communities from sewers serving 2,328,300 persons. The 31 sources of industrial wastes discharging directly to watercourses are almost all from the food, leather, textile and paper industries.

Existing Municipal and Industrial Treatment Facilities

Of the total of 98 sources of pollution only 30 receive treatment. Eighteen sources of sewage pollution with a total contributing population of 89,000 and 12 sources of industrial wastes have been provided with some degree of treatment. The industrial wastes from 18, possibly 19, sources and the sewage from 49 communities with sewered population of 2,239,000 is discharged without treatment. These and other data are summarized in Tables C_8 and D_8

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Table E_8 shows the adequacy of existing treatment facilities and it is to be noted that only 11 of these 29 existing facilities are adequate in providing the desired degree of treatment. These 11 satisfactory waste treatment facilities consist of nine sewage treatment plants and two industrial waste treatment facilities.

Progress in construction of projects to abate pollution is summarized in Table F_8 . During the period 1946 through June 1950 a total of 13 sewage works projects to serve 153,400 persons were completed. During this same period 19 industrial waste treatment projects were completed. The amounts of these industrial wastes now being treated is not available.

Table G_8 summarizes the requirements for municipal and industrial waste treatment plants.

Eleven new sewage treatment projects are needed to serve a total sewered population of nearly 2,090,000. Enlargements or additions are required at seven existing plants now inadequately serving 15,600 persons. One existing sewage plant needs replacement by adequate new facilities to serve 1,940 persons. The requirements for one sewered community of 8,000 has not been determined. Nine existing sewage treatment facilities require no project and seven other communities disposing of sewage by dilution, are considered not to require any treatment project at the time.

Eighteen new industrial waste treatment and disposal projects are required and nine existing facilities require enlargements or additions before treatment will be adequate. The requirements for two sources of industrial waste pollution have not been determined. Two sources of such pollution need no projects, being adequately served by existing plants.

The status of treatment works projects to abate pollution is given in Table H_8 . No formal action to abate pollution has been taken at 36 sources of pollution, 10 sources of pollution are in various stages of preparation to provide treatment works, and the status of three other sources is undetermined.

Municipalities and Industries Requiring Improvements to Abate Pollution

A list of the sources of pollution requiring improvements to abate pollution are given in Table

I_8 . Names of municipalities, institutions and military installations are given, but the names of firms are omitted in accordance with the policies or laws of several of the New England States.

Table A_8. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	20[1]	45,310	25,550
Having population data available (Data on pollution load to watercourse incomplete or not available)	47	2,283,030	Not applicable
Total	67	2,328,340	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] Includes one industry discharging sanitary sewage only from 10 employees.

Table B_8. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	1	3,000
Producing organic wastes	28	Undetermined.
Producing inorganic wastes	1	Not applicable.
Producing wastes of undetermined type	1	Undetermined.
Total	31	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_8.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	3	2[1]	63,800
Secondary	15	15	25,350
No treatment	49[2]	0	2,239,190

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] The one sewage treatment plant of the South Essex Sewerage District serves two municipalities.

[2] Includes one industry having sanitary sewage only from 10 employees.

Table D_8. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products..	4	3	1	0
Textile mill products......	9	2	7	0
Lumber and wood products...	0	--	--	--
Paper and allied products..	4	2	2	0
Chemical and allied products..................	2	1	1	0
Products of petroleum and coal......................	0	--	--	--
Rubber products............	1	0	1	0
Leather and leather products..................	7	4	3	0
Primary metal industries...	0	--	--	--
Fabricated metal products..	1	0	0	1
Miscellaneous..............	3	0	3	0
Total....................	31	12	18	1

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_8. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satis-factory	Unsatis-factory	Unde-termined	Satis-factory	Unsatis-factory	Unde-termined
Municipal	17	9	8	0	13	4	0
Industrial	12	2	8	2	4	5	3

Table F_8. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	1	5,000	0	--
1947	2	45,200	1	Data not available
1948	2	27,500	3	Data not available
1949	2	6,000	9	Data not available
to July 1950	6	69,700	6	Data not available

Table G_8. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	11[1]	2,089,690	18
Enlargement or additions to existing plant	7[2]	15,645	9[4]
Replace existing plant	1	1,940	0
No project required	16[3]	213,065	2
Undetermined	1	8,000	2

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] Includes Metropolitan District Commission (Boston Area) serving 33 communities and requiring only 3 projects to abate pollution (Boston Main Drainage listed here).

[2] Includes one municipality with adequate treatment for present loadings but which requires enlargement of existing plant to serve another area now being sewered.

[3] Includes 7 municipalities disposing of their sewage by dilution to tidal waters and one municipality with unsatisfactory private sewage treatment where pollution will be abated by adequate private disposal. South Essex Sewerage District Plant serving 2 municipalities also included.

[4] One industry having waste treatment of undetermined type and efficiency known to require additional treatment facilities.

Table H_8. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	12	24
Abatement ordered	1	0
Plans under preparation	1	2
Final plans approved	1	0
Construction awaiting financing	1	0
Under construction	3	1
Status undetermined	1	2

Table I_8. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		MASSACHUSETTS MUNICIPALITIES		
Atlantic Ocean	Municipal	Nahant	2,000	New plant
Boston Harbor	do	No. Metropolitan District	727,330	do
do	do	Boston Main[1] Drainage (MDC)	600,000	do
do	do	So. Metropolitan District	637,100	do
Plymouth Harbor	do	Plymouth	11,000	do
Buzzards Bay	do	New Bedford	110,000	do
Ipswich River	do	Ipswich	1,000	do
do	do	Old Vet Housing Ipswich	100	Add to existing plant
Crane River	do	Danversport Section, Danvers	100	New plant
Danvers River	do	Ober Pk. Section, Beverly	150	do
North River	do	Rockland	1,000	do

See footnotes at end of table.

Table I$_8$. Project list - municipalities and industries requiring improvements for abatement of pollution* September 1950--Continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
Charles River	Municipal	Milford	9,000	Add chlorination
do	do	Millis	100	Enlarge existing plant
do	do	Medfield	N	Add to existing plant
do	do	Medfield State Hospital	2,300	Add chlorination
Mine Brook	do	Franklin	3,900	do
Stop River	do	Pondville State Hospital	245	do
Tributary of Stop River	do	Wrentham State School	1,940	Replace existing plant
MASSACHUSETTS INDUSTRY WITH SANITARY SEWAGE ONLY				
Acushnet River	Fish products	New Bedford	10	New plant
MASSACHUSETTS INDUSTRIES WITH INDUSTRIAL WASTES				
Plymouth Harbor	Cordage manufacturing	Plymouth	N	New plant
Mud Cove	Cranberry sauce	Wareham	N	Add to existing plant
Farley Brook	Tannery	Ipswich	N	New plant
do	Laundry	do	N	do
Lubber Brook	Tannery	N. Wilmington	N	Add to existing plant
Goldthwait Br.	do	Peabody	N	New plant
do	Resins	do	N	do
Crane River	Tannery	Danvers	N	Add to existing plant
do	do	do	N	New plant
Waters River	Laundry	do	N	do
Aberjona River	do	Woburn	3,000	Add to existing plant
Neponset River	Textile	Walpole	N	do
do	Roofing paper	do	N	do
do	Paper	do	N	do
do	Textile	Hyde Park	N	New plant
Canton R.	Chicken slaughtering	Canton	N	Add to existing plant
do	Rubber goods	do	N	New plant
North River	Ice cream	Abington	N	do
Charles River	Wool scouring	Bellingham	N	Add to existing plant
do	Finish woolens	do	N	New plant
do	Carbonize and dye woolens	do	N	do
do	Textile finishing	Medway	N	do
do	Laundry	do	N	do
do	Paper	Waltham	N	do
Mine Brook	Felt	Franklin	N	do
do	do	do	N	do
Chicken Brook	Wool shoddy	W. Medway	N	do

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*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N=Information not available or does not apply.

[1] Part of Metropolitan District Commission.

MERRIMACK RIVER SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Merrimack River is an interstate stream and drains the fifth largest watershed in New England. The river has its headwaters in the White Mountains in New Hampshire. It drains about 3,800 miles of central New Hampshire and 1,200 miles of northeastern Massachusetts. The river flows in a southerly direction through New Hampshire and just after entering Massachusetts, turns abruptly east for a distance of about 45 miles where it empties into the Atlantic Ocean at Newburyport. The sub-basin has a maximum length of about 150 miles and is 50 miles in breadth at the widest point. The main stem of the Merrimack is about 110 miles long and is tidal during the last 22 miles of its length.

The terrain of the watershed is rugged in the headwaters region with peaks rising to 5,000 feet. The eastern and east central sections of the sub-basin are hilly with rolling country the general feature. In the western parts of the watershed the terrain is irregular with numerous hills of 1,000 to 1,200 feet in height. As the coastal plain is reached the watershed line becomes indefinite and the terrain is typically coastal lowland.

Rock formation is almost entirely granite or gneiss, with overburden of glacial sand and gravel. About one-fifth of the area is in cleared farmland, most of which is in the bottom lands of New Hampshire and scattered throughout the rolling country in Massachusetts. There is almost no virgin timberland in the sub-basin and the uncleared land is covered with second-and-third-growth spruce and mixed hardwoods.

The average annual precipitation in the sub-basin is about 42 inches, being about 44 inches in the mountainous regions and 37 inches in the lowlands. Summer temperatures average from 62° to 68° F. and winter temperature averages vary from 16° to 26° F., the lower averages prevailing in the northern portions of the sub-basin. There are 32 stream gaging stations in the sub-basin and records indicate the total run-off to average about 7,650 cubic feet per second.

Economic Development

The most productive farmland in the sub-basin lies in Massachusetts. Access to ready markets in nearby manufacturing cities has prompted agricultural activities to be directed to dairying, poultry raising, fruit growing and small-scale general farming. The value of farmland in the sub-basin in Massachusetts is among the highest in the State and becomes less in New Hampshire as the distance to markets increases. Dairy, poultry and truck garden products account for nearly 90 percent of all farm income which, in 1945, was an estimated $33,000,000.

The southern portion of the sub-basin is one of the oldest and most highly developed industrial areas in New England. The principal manufacturing centers are Manchester and Nashua, N.H. and Lowell, Lawrence and Haverhill, Mass. There are many small manufacturing cities and towns as well. The region suffered much economically during the period 1930-39 but efforts to diversify industry are bearing fruit and there is a growing stability in the economy of the area. The economy of the lower Merrimack Valley was once almost wholly dependent on the textile, leather and paper industries. These industries are still important activities in the sub-basin but now the machinery, chemical, fabricated metal, furniture, electrical instruments and other industries play a prominent role in the manufacturing income. There are an estimated 1,500 manufacturing establishments in the Merrimack Sub-Basin that employed approximately 170,000 persons in 1947. The total wages paid all manufacturing employees during that year is estimated to have been some $445,000,000 and the value added to products by manufacture was approximately $800,000,000.

Lumbering and mining play an insignificant role in the economy of the sub-basin. There is practically no mining or quarrying and lumbering in the northern parts of the sub-basin is on a very small scale.

Recreation is a most important industry to the economy of the northern portion of the sub-basin. The lakes region along the northeastern area have been particularly developed for recreation and annually attracts thousands of summer visitors. A very large investment of private capital has been made in summer homes, resort hotels and other recreational real estate, particularly around and near Lake Winnipesaukee, the most famous recreational area in this region.

The 1950 population of the sub-basin is estimated to be about 950,000, a gain of several percent over the 1940 figures. Lowell, with a 1950 population of 96,523, is the largest city in the Merrimack Sub-Basin and is closely followed in size by Lawrence, Mass. and Manchester, N.H.

Uses of Water Resources

As would be expected in a highly populated and industrialized river basin, the water resources are put to almost every conceivable legitimate water use. The most important use of the waters is for public water supply and the most economically important use is for industrial water supply. The most extensive use is undoubtedly for all forms of water recreational activity. Other prominent uses are for power development, navigation, shellfishing, wildlife habitat, livestock watering and transportation of wastes. The original industrial development of the sub-basin was a result of the availability and quantity of its water resources.

POLLUTION DATA

Damages to Water Resources from Pollution

The Merrimack River and its principal tributaries are among the most polluted of any river system in New England. At places in the sub-basin practically every water use has been damaged as a result of pollution. Damage has been greatest to recreational uses, with large volumes of water unsuitable for recreational bathing, game fishing and other recreational uses. Long stretches of the Nashua River and its tributaries, the Concord River and some of its tributaries, and the Pemigewasset River have been made unsuitable as sources of industrial water supply. Parts of the main stems of the Merrimack and Concord Rivers are unsuitable as public water supplies although they are used for that purpose. The same is true of a small tributary of the Sudbury River. During critical periods of high temperature and low run-off nuisance conditions exist at several points in the sub-basin.

Sources of Municipal and Industrial Pollution

Data on sources of pollution are summarized in Tables A_9 and B_9. There are a total of 150 separate sources of pollution, 71 resulting from the discharge of sewage, or combined industrial wastes and sewage, and 79 being contributed by industrial process wastes. Sanitary sewage pollution is contributed by a total of 623, 500 persons. Although recorded as three sources of municipal sewage pollution from a total of 228, 000, the combined sewage and industrial wastes from the Lowell-Lawrence-Haverhill area has a population equivalent of over 2, 000, 000. Manufacturing wastes in the sub-basin are largely organic in nature and are contributed to mainly by the discharge of paper mill, wool scouring and textile dyeing and finishing wastes.

Existing Municipal and Industrial Treatment Facilities

Of the total of 150 sources of pollution in the Merrimack River Sub-Basin, only 40 have treatment or disposal facilities. Twenty-eight sources of sewage pollution with a total of 160, 000 persons served receive treatment while 43 sources of sewage pollution with a connected population of 463, 000 persons is discharged untreated. Twelve sources of industrial wastes receive treatment before discharge to watercourses and 67 are discharged without treatment. These and other data are summarized in Tables C_9 and D_9.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Data on adequacy of existing treatment facilities are contained in Table E_9. Of the 28 sewage treatment works, 15 are adequate in capacity and operation, 10 are inadequate in capacity, and the status of three is undetermined. Two of the 12 industrial waste treatment facilities are satisfactory, six are inadequate in capacity and the status of four has not been determined.

There has been little progress in construction of treatment works to abate pollution since the war as shown by Table F_9. During the period 1946 through July 1950 only one sewage treatment plant to serve 1, 000 persons was completed. In this same period two industrial waste treatment facilities were placed in operation.

The requirements for municipal and industrial waste treatment plants are summarized in Table G_9. Forty new sewage projects are required to serve a total of 462, 400 persons. Nine existing sewage treatment works now serving 26,000 persons need additions or enlargements before treatment will be satisfactory. Five existing sewage treatment facilities are so inadequate in design and capacity as to require replacement before the treatment of sewage from 27, 500 persons is satisfactory. No project is required for 14 sources of sewage pollution contributed by 107, 000 persons that are now adequately served by satisfactory treatment facilities. The needs for three small sources of sewage pollution from less than 500 persons have not been determined. Of the total of 79 sources of industrial waste pollution, 26 new treatment or disposal facilities are needed, nine existing plants require additions or enlargements, one existing plant needs to be replaced by a new plant, 41 sources require determination of treatment needs, and two existing plants require no projects as existing facilities are adequate.

Status of treatment works projects to abate pollution is given in Table H_9. No formal action has been taken to abate pollution at 45 sources of sewage and 30 sources of industrial waste pollution. Orders to construct works to abate pollution at three sources of sewage and one source of industrial waste pollution have been ordered. Four municipalities have plans for sewage treatment works under preparation, two have plants under construction and the needs for projects by three others have not been determined. New industrial waste treatment facilities are under construction at four manufacturing plants and the requirements for 41 other sources of industrial wastes need to be determined.

Municipalities and Industries Requiring Improvements to Abate Pollution

A list of the projects at sources of pollution requiring improvements to abate pollution is given in Table I_9. The names of manufacturing plants have been omitted in compliance with the established policies or laws of several of the New England States.

No projects to abate industrial waste pollution in New Hampshire have been included in Table I_9. Such projects are known to be necessary but the types of projects and where they will be required have not been determined. Rather than present inaccurate information, these data have been omitted.

Table A_9. Source of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	58[1]	410,481	2,581,122
Having population data available (Data on pollution load to watercourse incomplete or not available)	13	213,086	Not applicable
Total	71	623,567	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] Includes two industries discharging sanitary wastes only; 600 employees.

Table B_9. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	20	242,332
Producing organic wastes	57	Undetermined.
Producing inorganic wastes	2	Not applicable.
Producing wastes of undetermined type	0	Undetermined.
Total	79	- -

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_9.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	6[1]	6	6,750
Secondary	22	22	153,932
No treatment	43[2]	0	462,885

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] Includes one industry having sanitary sewage only from 450 employees.

[2] Includes one industry having sanitary sewage only from 150 employees.

Table D_9. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products..	1	1	0	0
Textile mill products......	45	4	41	0
Lumber and wood products...	1	0	1	0
Paper and allied products..	17	4	13	0
Chemical and allied products..................	1	0	1	0
Products of petroleum and coal..........................	1	1	0	0
Rubber products............	1	0	1	0
Leather and leather products..................	7	0	7	0
Primary metal industries...	0	0	0	0
Fabricated metal products..	2	1	1	0
Miscellaneous..............	3	1	2	0
Total..................	79	12	67	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_9. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	28	15	10	3	21	4	3
Industrial	12	2	6	4	7	1	4

Table F_9. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	1	Not available
1947	--	--	--	--
1948	--	--	--	--
1949	1	1,000	1	Not available

Table G_9. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	40	462,400	26
Enlargement or additions to existing plant	9[1,2]	26,086	9[3]
Replace existing plant	5	27,500	1[4]
No project required	14	107,096	2
Undetermined	3	485	41

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] One treatment plant of satisfactory design and operation will require enlargement to increase capacity.

[2] One industry with sanitary sewage only and two municipal treatment plants, all of undetermined design and operation, are known to require additions.

[3] Three industrial waste treatment plants of undetermined design and operation are known to require additions.

[4] One industrial waste treatment plant of undetermined design and operation known to require replacement.

Table H_9. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	45	30
Abatement ordered	3	1
Plans under preparation	4	0
Final plans approved	0	1
Construction awaiting financing	0	0
Under construction	2	4
Status undetermined	3	1

Table I_9. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		MASSACHUSETTS MUNICIPALITIES		
Merrimack River	Municipal	Lowell	101,000	New plant
do	do	Dracut	6,400	do
do	do	Methuen	23,000	do
do	do	Lawrence	85,000	do
do	do	Andover	11,900	do
do	do	No. Andover	7,900	do
do	do	Haverhill	46,000	do
do	do	Amesbury	10,800	do
do	do	Newburyport	14,000	do
do	Recreational area	Salisbury Bch.	2,000	Replace existing plant
So. Nashua River	Municipal	Clinton	12,736	Add to existing plant
do	College	Atlantic Union College	500	Replace existing plant
Concord River	Municipal	No. Billerica	300	Add to existing plant
Assabet River	do	Westborough	2,800	do
do	do	Hudson	5,300	Enlarge existing plant

See footnotes at end of table.

Table 19. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950—Continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
Cochituate Br.	Municipal	Framingham	17,000	Replace existing plant
do	do	Natick	6,000	do
MASSACHUSETTS INDUSTRY HAVING SANITARY SEWAGE ONLY				
Shawsheen River	Chemical Plant	Ballardvale	450	Add to existing plant
MASSACHUSETTS INDUSTRIES HAVING INDUSTRIAL WASTES				
Catacoonamug Brook	Cordage manufacturing	Shirley	288	New plant
Nonacoicus Brook	Tannery	Ayer	5,202	do
Nashua River	Paper manufacturing	E. Pepperell	23,800	do
No. Nashua River	De-inking and paper manufacturing	Fitchburg	44,600	Add to existing plant
do	do	do	72,900	New plant
do	Paper coating	do	N	Add to existing plant
do	Toys and baby carriages	do	24	New plant
do	Gas manufacturing	do	228	Add to existing plant
do	Wool finishing	do	26,200	do
do	De-inking and paper manufacturing	do	25,400	New plant
do	Paper manufacturing	Leominster	5,706	do
do	Laundry	do	132	do
Monoosnock Brook	Pyroxoloid sheeting	do	12	do
So. Nashua River	Textile dyeing	Clinton	162	do
do	Plush manufacturing	do	1,500	do
do	Worsteds	do	498	do
Squannacook River	Paper manufacturing	W. Groton	25,000	Replace existing plant
do	Leather board manufacturing	W. Groton	2,780	Add to existing plant
Stoney Brook	Wool scouring	Forge Village	N	do
do	Wool combing	Chelmsford	N	New plant
do	do	do	N	do
Beaver Brook	Woolen mill	Dracut	N	do
do	Textile dyeing	do	N	do
do	do	do	N	do
Concord River	Wool fabric manufacturing	Billerica	N	do
do	Wool cloth manufacturing	do	N	do
Assabet River	Wool scouring	Hudson	N	Add to existing plant
do	do	Maynard	N	do
Sudbury River	Carpet mill	Saxonville	N	New plant
No. Branch Sudbury River	Meat packing	Ashland	N	Add to existing plant
Shawsheen River	Rubber products	Andover	100	New plant
do	Textile manufacturing	do	N	do
do	Laundry	Lawrence	N	do
Powow River	Paper manufacturing	Amesbury	N	do
do	Hat manufacturing	do	N	do
Nubanusit Br.	Wood dyeing	Harrisville	N	do

See footnotes at end of table.

Table 19. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--Continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		NEW HAMPSHIRE MUNICIPALITIES		
Merrimack River	Municipal	Concord	22,000	New plant
do	do	Pembroke	2,000	do
do	do	Manchester	60,000	do
do	do	Merrimack	200	do
do	do	Nashua	27,000	do
do	do	Hudson	800	do
Lake Winnipesaukee	do	Wolfeboro	1,500	Add to existing plant
do	do	Meredith	3,000	New plant
L. Winnisquam	do	Laconia	15,000	do
do	Institution	Laconia State School	2,000	Replace existing plant
Winnipesaukee River	Municipal	Tilton	1,500	New plant
do	do	Franklin	4,800	do
Pemigewasset River	do	N. Woodstock	500	do
do	do	Beebe River	800	do
do	do	Plymouth	2,000	do
E. Branch Pemigewasset River	do	Lincoln	800	do
Mad River	do	Campton	300	do
Squam River	do	Ashland	700	do
Newfound River	do	Bristol	1,000	do
Contoocook River	do	Jaffrey	1,000	Add to existing plant
do	do	Peterborough	300	do
do	do	Hillsboro	1,000	New plant
do	do	Henniker	600	do
do	do	W. Hopkinton	300	do
do	do	Boscawen	400	do
Great Brook	do	Antrim	100	do
Lane River	do	New London	1,700	Enlarge existing plant
do	do	Warner	1,000	New plant
Suncook River	do	Pittsfield	1,000	do
Piscataquog River	do	Goffstown	3,000	do
do	Institutional	Hillsboro County Farm	350	do
Souhegan River	Municipal	Greenville	900	do
do	do	Wilton	1,000	do
do	do	Milford	4,000	do
do	do	Merrimack	200	do
		NEW HAMPSHIRE INDUSTRY HAVING SANITARY SEWAGE ONLY		
Beebe River	Woodworking	Campton	150	New plant

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = Information not available or does not apply.

PISCATAQUA AND HAMPTON RIVERS SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Piscataqua River is a 12-mile long tidal estuary into which flow the Salmon Falls, Cocheco, Lamprey and Exeter Rivers. The sub-basin drains 240 square miles of the most southwestern part of Maine and 790 square miles in southeastern New Hampshire, a total of 1,030 square miles. The Hampton River is a small tidal estuary draining about 40 square miles of the southeastern coastal area of New Hampshire. In the northern parts of the sub-basin the terrain is rough and elsewhere it is of low elevation and rolling country. The geology is principally granite covered with glacial deposits of sand and gravel. About one-fifth of the area is cleared farmland and the remainder is second-growth woodland.

Rainfall is fairly uniform throughout the year and the average annual precipitation is about 39 inches. U.S. Geological Survey data are available for three gaging stations on the Piscataqua and the records indicate the average annual run-off in the sub-basin to be 1,620 cubic feet per second.

Economic Development

Agriculture is an important activity in the Piscataqua River Sub-Basin and farming is of a generally specialized nature. The sale of dairy and poultry products account for more than 40 percent of farm income. A ready market for farm produce is available in the nearby population centers.

There is a fair amount of industrial activity in the sub-basin. Lumbering activities account for the major share of manufacture, followed by leather and leather products industries. There are an estimated 240 manufacturing plants in the sub-basin, many quite small, that employed about 18,000 persons in 1947. The total payroll for manufacturing employees was some $42,000,000 in 1947 and the value added to products by manufacture was an estimated $72,000,000.

The use of the sub-basin for recreational purposes has been well developed and the area is popular with vacationists. A large number of summer homes have been built in the sub-basin. All types of recreational pursuits are available in which the water resources play the most important role.

The 1950 population in the sub-basin is estimated to be 107,000. There are 10 cities and towns of over 2,500 and these contain nearly three-fourths of the sub-basin population. Portsmouth, New Hampshire, is the largest city in the sub-basin with a reported 1950 population of 18,793.

Uses of the Water Resources

Extensive use is made of the water resources for all purposes except public water supply. The most widespread use is for all types of recreation. There are considerable activities in the commercial fishing and shellfish industries, and use of the water resources as a source of industrial process water is very important. The water resources are the most valuable of the natural resources of the sub-basin.

POLLUTION DATA

Damages to Water Resources from Pollution

Damages to the water resources from pollution have been extensive. Damages have been greatest to the recreational value of the waters, particularly for game fishing and bathing. There has also been considerable damage to the shellfish operations. No damages have been reported on other uses of the water resources.

Sources of Municipal and Industrial Pollution

Data on sources of municipal and industrial pollution are contained in Tables A_{11} and B_{11}. There are a total of 53 separate sources of pollution, 35 from the discharge of sewage with a total population served of 85,250 persons and 18 from industrial wastes. Industrial wastes originate principally from processing textile goods and other sources are from food, leather and paper industries.

Existing Municipal and Industrial Treatment Facilities

Tables C_{11} and D_{11} list the number and status of existing treatment facilities. Six sources of sewage pollution with a connected population of 15,000 persons receive treatment but none of 18 sources of industrial wastes are treated.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Of the six sources of sewage pollution provided with treatment works, three receive adequate treatment while three sources of sewage pollution receive treatment in plants that are unsatisfactory in capacity and operation. These data are shown in Table E_{11}.

Table G_{11} summarizes the requirements for municipal and industrial waste treatment plants to abate pollution. Twenty-nine new sewage treatment works to serve 70,500 persons and improvements to three existing plants are required. Two new industrial waste treatment works are needed and the status of 16 other sources of industrial pollution is undetermined.

Table A_{11}. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	31[1]	53,050	47,798
Having population data available (Data on pollution load to watercourse incomplete or not available)	4	32,200	Not applicable.
Total	35	85,250	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] Includes 3 industries discharging sanitary sewage only from 875 employees.

Table H_{11} gives the status of treatment works projects to abate pollution. Plans for one sewage treatment plant are under preparation, two sources of sewage pollution have been ordered to abate pollution and no formal action has been taken against 29 sources of sewage and 2 sources of industrial waste pollution.

Municipalities and Industries Requiring Improvements to Abate Pollution

A list of the sources of pollution requiring improvements to abate pollution is given in Table I_{11}. The names of firms, resorts and institutions are given but names of manufacturing plants have been excluded in accordance with the policies or laws of several of the New England States.

No projects to abate industrial waste pollution in New Hampshire have been included in Table I_{11}. Such projects are known to be necessary but the types of projects and where they will be required have not been determined. Rather than present inaccurate information, these data have been omitted.

Table B_{11}. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	0
Producing organic wastes	18	Undetermined.
Producing inorganic wastes	0	Not applicable.
Producing wastes of undetermined type	0	Undetermined.
Total	18	—

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_{11}.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	3	3	8,300
Secondary	3	3	6,450
No treatment	29[1]	0	70,500

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] Includes 5 industries discharging sanitary sewage only from 875 employees.

Table D_{11}. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products	1	0	1	0
Textile mill products	12	0	12	0
Lumber and wood products	0	—	—	—
Paper and allied products	1	0	1	0
Chemical and allied products	2	0	2	0
Products of petroleum and coal	0	—	—	—
Rubber products	0	—	—	—
Leather and leather products	2	0	2	0
Primary metal industries	0	—	—	—
Fabricated metal products	0	—	—	—
Miscellaneous	0	—	—	—
Total	18	0	18	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_{11}. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	6	3	3	0	3	3	0
Industrial	0	—	—	—	—	—	—

Table F_{11}. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	0	--	0	--
1948	0	--	0	--
1949	0	--	0	--

Table G_{11}. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	29	70,500	2
Enlargement or additions to existing plant	3	9,800	0
Replace existing plant	0	0	0
No project required	3	4,950	0
Undetermined	0	0	16

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

Table H_{11}. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	29	2
Abatement ordered	2	0
Plans under preparation	1	0
Final plans approved	0	0
Construction awaiting financing	0	0
Under construction	0	0
Status undetermined	0	16

Table I_{11}. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people	Project requirements
MAINE MUNICIPALITIES				
Piscataqua River	Municipal	Berwick	400	New plant
do	do	So. Berwick	200	do
do	do	Kittery	3,000	do
do	Sanitary sewage	Kittery Navy Yard	4,200	do
Great Works River	Municipal	N. Berwick	1,200	do
Goodall Brook	do	Sanford	5,000	do
York River	do	York Village	100	do
do	do	York Harbor	500	do
do	do	York Beach	3,500	do
MAINE INDUSTRY - WITH SANITARY SEWAGE ONLY				
Piscataqua River	Shoes	So. Berwick	285	New plant
MAINE INDUSTRIES WITH INDUSTRIAL WASTES				
Piscataqua River	Tannery	Berwick	Unknown	New plant
Great Works River	Woolen mill	N. Berwick	do	do
NEW HAMPSHIRE MUNICIPALITIES				
Piscataqua River	Municipal	Portsmouth	13,000	do
do	do	New Castle	1,000	do
Cocheco River	do	Farmington	1,500	do
do	do	Rochester	9,000	do
do	do	Dover (part)	10,000	do
Salmon Falls River	do	Milton	800	do
do	do	E. Rochester	1,500	do
do	do	Somersworth	3,500	do
do	do	Salmon Falls	1,000	do
Bellamy River	do	Dover (part)	1,500	do
Oyster River	do	Durham	3,500	Add to existing plant
Lamprey River	do	Raymond	500	New plant
do	do	Epping	500	do
do	do	Newmarket	2,500	do
Exeter River	County farm	Brentwood	300	Enlarge existing plant
do	School	Exeter Academy	725	New plant
do	Municipal	Exeter	4,500	do
do	do	Hampton	6,000	Enlarge existing plant
NEW HAMPSHIRE INDUSTRIES WITH ONLY SANITARY SEWAGE				
Cocheco River	Fiber boards	Rochester	94	New plant
Lamprey River	Shoes	Raymond	230	do
do	do	Epping	126	do
Piscataqua River	Gypsum	Portsmouth	140	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

SOUTH MAINE COASTAL STREAMS SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The South Maine Coastal Streams Sub-Basin lies in the southwest corner of Maine and drains about one-third of York County. The two principal streams in the sub-basin are the Mousam and Kennebunk Rivers. There are several other smaller brooks and streams along the coast. The Mousam River has a drainage area of about 200 square miles and the Kennebunk River drains some 38 square miles. The sub-basin is somewhat triangular in shape, being about 25 miles wide on each side.

The terrain is typically coastal lowland with some rolling hills away from the flat coastal areas. The underlying rock is granite with a glacial sand and gravel overburden. About 25 percent of the sub-basin is in cleared farmland and the remainder is cut-over woodland, much of which is on the farms.

The average annual precipitation is about 43 inches, distributed evenly throughout the year. Winter temperatures average 25°F. and summer temperatures average near 66° F. No discharge records are kept in any of the streams in this sub-basin, so run-off figures are not available.

Economic Development

Farming is an important activity in the sub-basin and ready markets for produce are available. Almost three-fourths of farm revenue is derived from the sale of dairy and poultry products. The value of all farm products sold in the sub-basin in 1945 was approximately $1,400,000.

There are a number of industries in the sub-basin, principally engaged in textile processing and the manufacture of shoes and wood products. There are an estimated 65 manufacturing establishments employing approximately 8,000 persons. The total income for all manufacturing employees in 1947 was approximately $18,500,000 and the value added to products by manufacture was $38,000,000.

The coastal areas of the South Main Coastal Streams Sub-Basin are intensively developed for recreational purposes and the value of such real estate is high. The area has many physical attractions for vacationists and tourists and has been very popular for years.

The 1950 population in the sub-basin is estimated to be 42,000. Kennebunk is the largest community with a population estimated to be over 4,000 in 1950. The summer influx of vactionists and tourists swells the normal population level appreciably.

Uses of Water Resources

The principal use of the surface water resources of this small sub-basin is for all types of recreational use. The coastal waters are used for the propagation of shellfish. The Mousam River at Sanford serves as a source of industrial water supply and the Kennebunk River is used for navigation purposes.

POLLUTION DATA

Damages to Water Resources from Pollution

The available data do not indicate the extent to which damages to the water resources have resulted from pollution. The principal source of pollution is sanitary sewage. From the data available, it is believed that damage has been greatest to the recreational uses of the waters, their most important use in this sub-basin.

Sources of Municipal and Industrial Pollution

Tables A_{12} and B_{12} show the number of sources of sewage and industrial waste pollution and the population served where applicable. There are 15 sources of pollution, 14 from the discharge of sewage having a population equivalent of 15,300 persons, and one from organic industrial waste. Five of the sources of sewage pollution arise from discharge of sanitary wastes by manufacturing plants.

Existing Municipal and Industrial Treatment Facilities

Of the existing 14 sources of pollution in the sub-basin only one receives treatment. This is at Ogunquit which provides sedimentation, some chemical flocculation and chlorination for the sewage from 3,000 persons. The one source of industrial waste (textile) pollution is untreated. These data are included in Tables C_{12} and D_{12}.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Table E_{12} shows that the one existing sewage treatment facility in the sub-basin is unsatisfactory in capacity. This sewage treatment plant located at Ogunquit, was constructed in 1920.

Table G_{12} summarizes the requirements for municipal and industrial waste treatment plants and shows that all sources of pollution require some project. Thirteen new sewage treatment facilities are needed and the existing sewage treatment plant requires additions.

No formal action has as yet been taken to abate pollution in this sub-basin as shown by the summary in Table H_{12}.

Municipalities and Industries Requiring Improvements to Abate Pollution

The municipalities and industries requiring improvements to abate pollution are given in Table I_{12}. The names of communities are given but the name of the textile firm at Sanford has been omitted in accordance with the policies or laws of several of the New England States.

Table A_{12}. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	14[1]	17,180	15,380
Having population data available (Data on pollution load to watercourse incomplete or not available)	0	0	Not applicable.
Total	14	17,180	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] 5 industries discharge sanitary sewage only; 1030 employees.

Table B_{12}. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	0
Producing organic wastes	1	Undetermined.
Producing inorganic wastes	0	Not applicable.
Producing wastes of undetermined type	0	Undetermined.
Total	1	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_{12}. Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	1	1	3,000
Secondary	0	0	0
No treatment	13[1]	0	14,180

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] Includes 5 industries discharging sanitary sewage from 1,030 employees.

Table D_{12}. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products	--	--	--	--
Textile mill products	1	0	1	0
Lumber and wood products	--	--	--	--
Paper and allied products	--	--	--	--
Chemical and allied products	--	--	--	--
Products of petroleum and coal	--	--	--	--
Rubber products	--	--	--	--
Leather and leather products	--	--	--	--
Primary metal industries	--	--	--	--
Fabricated metal products	--	--	--	--
Miscellaneous	--	--	--	--
Total	1	0	1	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_{12}. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	1	0	1	0	0	0	1
Industrial	0	0	0	0	0	0	0

Table F_{12}. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	0	--	0	--
1948	0	--	0	--
1949	0	--	0	--

Table G_{12}. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	13	14,180	1
Enlargement or additions to existing plant	1	3,000	0
Replace existing plant	0	0	0
No project required	0	0	0
Undetermined	0	0	0

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

Table H_{12}. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	14	1
Abatement ordered	0	0
Plans under preparation	0	0
Final plans approved	0	0
Construction awaiting financing	0	0
Under construction	0	0
Status undetermined	0	0

Table I_{12}. Project list - municipalities and industries requiring improvements for abatement of pollution,* September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people	Project requirements
MAINE MUNICIPALITIES				
Atlantic Ocean	Municipal	Wells Beach	6,000	New plant
Cape Neddick River	Grammar school	York Beach	100	do
do	Municipal	Cape Neddick	500	do
Ogunquit River	do	Ogunquit	3,000	Add to existing plant
Mousam River	do	Sanford	5,000	New plant
do	do	Kennebunk	1,000	do
Kennebunk River	do	do	200	do
do	do	Kennebunkport	200	do
South Brook	do	do	150	do
MAINE INDUSTRIES WITH SANITARY SEWAGE ONLY				
Mousam River	Novelty shoes	Springvale	350	New plant
do	Shoes	Sanford	430	do
do	Yarn mills	do	90	do
do	Shoe counters	Kennebunk	60	do
do	Shoes	do	100	do
MAINE INDUSTRIES WITH INDUSTRIAL WASTES				
Mousam River	Textile finishing	Sanford	Not available	New plant

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

SACO RIVER SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Saco River Sub-Basin drains about 830 square miles of southwestern Maine and 900 square miles of east central New Hampshire, a total drainage area of 1,730 square miles. The river rises in the White Mountains in New Hampshire and flows southeasterly for 80 miles where it empties into the Atlantic Ocean near Biddeford, Maine.

The upper reaches of this sub-basin are in high, rugged country, the central valley is rolling and the coastal area is relatively level. The general rock formation is granite with some limestone and schist. Most of the sub-basin is wooded, with about 10 percent of the sub-basin near the coast in cleared farmland.

Summer temperatures average about 66°F. at the lower altitudes and winter temperatures vary from 15° to 25°F., being lower at the higher altitudes.

The Ossipee River is the principal tributary to the Saco River. Run-off records are available and indicate that the average annual run-off in the Saco River Sub-Basin is approximately 3,550 cubic feet per second.

Economic Development

About one-third of the land area of the Saco Sub-Basin is in farmland and much of this is in pasture and woodland. The soil is not very fertile and most of the farm income is derived from the sale of dairy and poultry products. Lumbering is on a small scale and farm woodlots contribute a small amount to farm revenue. Mining is of no consequence.

Industry has been developed to some extent in the sub-basin, and there are probably about 100 manufacturing establishments of all types. Lumbering and lumber products account for most of the manufacturing activity, followed by processing of leather and textile products. It is estimated that there are about 7,000 manufacturing employees who earned salaries and wages in 1947 of approximately $17,000,000. The value added to products by manufacture in 1947 was some $37,000,000.

The 1950 population in the sub-basin is estimated to be 59,000--a small increase over the 1940 figures. Biddeford, Maine, is the largest city in the sub-basin with an estimated 1950 population of 22,000.

Uses of the Water Resources

The water resources of the Saco River Sub-Basin are put to nearly all normal uses. The most extensive uses are for all types of water recreation and wildlife habitat. The waters are used for public and industrial water supply, livestock watering, commercial fishing, and shellfish propagation. There are no navigational uses of the Saco River.

POLLUTION DATA

Damages to Water Resources from Pollution

The most extensive damage to the water resources is to recreational use for bathing and game fishing, principally caused by sewage pollution. Some 15 miles of the Saco River below West Buxton, Maine, is damaged for use as a public water supply source by Biddeford and Saco, although these two cities must rely on this source. There have been no damages reported on other water uses.

Sources of Municipal and Industrial Pollution

Data on sources of sewage and industrial waste pollution are given in Tables A_{13} and B_{13}. There are a total of 27 sources: 20 discharging sewage from a contributing population of 41,800 and seven discharging industrial wastes. Industrial wastes are principally from the processing of cotton and woolen textiles.

Existing Municipal and Industrial Treatment Facilities

Of the 27 sources of pollution in the Saco Sub-Basin, four receive treatment. There are three sewage treatment plants serving a total of 750 persons and one industrial waste treatment plant. These and other data are given in Tables C_{13} and D_{13}.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

As shown in Table E_{13}, two of the three sewage treatment plants are satisfactory as to capacity and operation. The status of the one industrial waste treatment plant is undetermined. One sewage treatment plant is over-loaded and treatment is unsatisfactory.

Tables G_{13} and H_{13} show the requirements for and status of treatment works projects. Twenty projects are required; 14 new sewage and five new industrial waste treatment plants, and additions to one existing municipal sewage works. No formal action to abate pollution has been taken except at one municipality where abatement has been ordered.

Municipalites and Industries Requiring Improvements to Abate Pollution

Table I_{13} is a list of the sources of sanitary sewage and industrial waste pollution requiring improvements for abatement of pollution. The names of manufacturing plants are not given in accordance with the policies or laws of several of the New England States.

No projects to abate industrial waste pollution in New Hampshire have been included in Table I_{13}. Such projects are known to be necessary but the types of projects and where they will be required have not been determined. Rather than present inaccurate information, these data have been omitted.

Table A_{13}. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	17[1]	34,807	34,241
Having population data available (Data on pollution load to watercourse incomplete or not available)	3	7,000	Not applicable
Total	20	41,807	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] Includes one industry having only sanitary sewage from 92 employees.

Table B_{13}. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	0
Producing organic wastes	6	Undetermined
Producing inorganic wastes	1	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	7	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_{13}.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	0	0	0
Secondary	3	3	750
No treatment	17[1]	0	41,057

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] Includes one industry having sanitary sewage only from 92 employees.

Table D_{13}. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products.	1	1	0	0
Textile mill products.....	3	0	3	0
Lumber and wood products..	0	0	0	0
Paper and allied products.	1	0	1	0
Chemical and allied products....................	0	0	0	0
Products of petroleum and coal....................	0	0	0	0
Rubber products...........	0	0	0	0
Leather and leather products....................	1	0	1	0
Primary metal industries..	0	0	0	0
Fabricated metal products.	1	0	1	0
Miscellaneous.............	0	0	0	0
TOTAL	7	1	6	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_{13}. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	3	2	1	0	2	1	0
Industrial	1	0	0	1	0	0	1

Table F_{13}. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	0	--	0	--
1948	0	--	0	--
1949	0	--	0	--

Table G_{13}. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	14	40,717	5
Enlargement or additions to existing plant	1	300	0
Replace existing plant	0	0	0
No project required	5[1]	790	1[2]
Undetermined	0	0	1

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] Untreated sewage pollution from private sewers in three small towns will be abated by adequate private disposal.

[2] One industrial waste treatment plant of undetermined design and operation requires no project for the present.

Table H_{13}. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	14	5
Abatement ordered	1	0
Plans under preparation	0	0
Final plans approved	0	0
Construction awaiting financing	0	0
Under construction	0	0
Status undetermined	0	1

Table I_{13}. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
NEW HAMPSHIRE MUNICIPALITIES				
Saco R.	Municipal	Bartlett	300	New plant
do	do	N. Conway	800	do
do	do	Conway	1,000	do
Wildcat Brk.	Hotel	Jackson	300	Enlarge existing plant
MAINE MUNICIPALITIES				
Saco R.	Municipal	Fryeburg	50	New plant
do	do	W. Buxton	75	do
do	do	Bar Mills	50	do
do	do	Biddeford	15,000	do
do	do	Saco	4,500	do
Ward Pond	do	Fryeburg	500	do
Goosefare Brk.	do	Saco	1,000	do
Halls Brook	do	do	300	do
Atlantic Ocean	do	Old Orchard Beach	30,000	do
do	do	Scarboro	550	do

See footnotes at end of table.

Table I_{13}. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950—Continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		MAINE INDUSTRY WITH SANITARY SEWAGE ONLY		
Saco R.	Heel manufacturing plant	Conway	92	New plant
		MAINE INDUSTRIES WITH INDUSTRIAL WASTES		
Saco R.	Wood fibre	Bar Mills	N	New plant
do	Textile mill	Biddeford	N	do
do	Textile machinery	do	N	do
do	Rawhide	Saco	N	do
do	Textiles	do	N	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = Information not available or does not apply.

PRESUMPSCOT RIVER AND CASCO BAY SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Presumpscot River and other streams entering Casco Bay drain approximately 950 square miles of the southwestern part of Maine. The only other river of consequence in this sub-basin is the Royal River which drains the largest area to the east of the Presumpscot Sub-Basin. The Presumpscot Sub-Basin is about 55 miles long with a maximum width of about 20 miles. The river flows in a southeasterly direction, emptying into Casco Bay a few miles above Portland.

The terrain of the sub-basin is generally rolling country except near the ocean where the flat coastal plain is reached. The Presumpscot River and Casco Bay Sub-Basin contains two large lakes that account for more than 13 percent of the watershed area. Rock formation is mainly granite, covered with glacial sand and gravel. About one-fifth of the sub-basin is in cleared farmland and the remainder is principally cut-over woodland that has been reseeded to hardwoods and conifers.

Precipitation is rather uniform throughout the sub-basin and through the seasons, averaging about 42 inches annually. Summer temperatures average about 66°F. and winter temperatures about 22°F.

The average annual run-off in the Presumpscot River Sub-Basin above the outlet of Sebago Lake is about 1.48 second feet per square mile. Since the geology and precipitation characteristics are rather uniform throughout this sub-basin, the average annual run-off is estimated to be a little more than 1,400 cubic feet per second.

Economic Development

The land of the sub-basin is rather fertile and, because of the proximity to markets, agriculture is profitable. The value of all farm products sold in 1945 was over $5,000,000. Farm income was derived principally from the sale of dairy and poultry products.

Industry is not on a large scale in this sub-basin, although Cumberland County, almost the whole of which is included in the watershed, is the third largest in the number of manufacturing employees in the State of Maine. There are approximately 275 manufacturing establishments in the sub-basin that employ an estimated 12,000 persons. Total salaries and wages paid was about $29,400,000 in 1947 and the value added to products by manufacture was approximately $57,000,000.

The land and water resources of the Presumpscot River and Casco Bay sub-basin are extensively used for recreational purposes. Lake Sebago is a particularly popular water area and the headwaters area of the Presumpscot abounds in wildlife. The abundance of recreational opportunities in a readily accessible region makes this sub-basin area particularly favorable for this type of development.

The 1950 population of the sub-basin is estimated to be 145,000, of which more than half live in Portland, the largest and most important city in the sub-basin. Most of the population is centered along the coast and the northern regions of the sub-basin are sparsely settled.

Uses of Water Resources

Almost every normal use is made of the water resources of the Presumpscot River and the coastal streams. Public water supply is the most important use of the waters, and a variety of recreational uses are probably the most extensive. Industrial and livestock water supply, commercial fishing, shellfish propagation, wildlife habitat and navigation are other important water uses.

POLLUTION DATA

Damages to Water Resources from Pollution

Damages to the water resources have not been extensive and for the most part have been confined to limiting recreational bathing. The streams of the sub-basin receive an appreciable amount of sewage pollution but this, together with industrial wastes, is not considered to seriously impair the normal uses of the water resources at the present time, except the 11 miles of the Presumpscot River below Westwood where a nuisance condition exists until dilution occurs in the tidal waters of Casco Bay.

Sources of Municipal and Industrial Pollution

Data on sources of sewage and industrial waste pollution are contained in Tables A_{14} and B_{14}. There are 22 sources of sewage pollution from cities, villages, industries, schools and institutions contributed by a total of 95,500 persons. Industrial waste pollution is discharged by 10 plants engaged in textile processing, poultry slaughtering, paper pulp manufacture and food processing.

Existing Municipal and Industrial Treatment Facilities

There are a total of 32 sources of sewage and industrial wastes pollution in this subbasin. Only three sources of sewage pollution receive treatment. All other sources of pollution discharge waste untreated. These data appear summarized in Tables C_{14} and D_{14}.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Of the three communities providing sewage treatment facilities, two provide satisfactory treatment and the third which employes a septic tank provides unsatisfactory treatment. This information is incorporated in Table E_{14}.

Table A_{14}. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	20[1]	11,080	9,425
Having population data available (Data on pollution load to watercourse incomplete or not available)	2	84,500	Not applicable.
Total	22	95,580	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] 3 industries discharge sanitary sewage only, 285 employees.

There has been little progress since 1946 in pollution abatement as shown by Table F_{14}. One municipality constructed septic tanks for the treatment of sewage from 1,400 persons in 1948.

Tables G_{14} and H_{14} show the requirements for and status of treatment works projects. Twenty-three sources of pollution require treatment projects for which no formal action has been taken. Fourteen new sewage treatment facilities to serve nearly 93,000 persons are needed and eight new industrial waste treatment works are required. One small existing sewage treatment facility requires additions. Five small villages dispose of sewage by dilution which is considered to be satisfactory for the present. This method of disposal is also used for industrial wastes by two manufacturing plants.

Municipalities and Industries Requiring Improvements to Abate Pollution

Table I_{14} is a list of the sources of domestic sewage and industrial waste pollution requiring improvements for abatement of pollution. The names of municipalities, schools and institutions are given but the names of firms are omitted in accordance with the policies or laws of several of the New England States. Instead, the type of waste, location and receiving stream are given.

Table B_{14}. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	0
Producing organic wastes	10	Undetermined.
Producing inorganic wastes	0	Not applicable.
Producing wastes of undetermined type	0	Undetermined.
Total	10	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_{14}.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	1	1	125
Secondary	2	2	2,200
No treatment	19[1]	0	93,255

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] Includes 3 industries discharging sanitary sewage only, 285 employees.

Table D_{14}. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products..	6	0	6	0
Textile mill products......	3	0	3	0
Lumber and wood products...	0	--	--	--
Paper and allied products..............	1	0	1	0
Chemical and allied products..............	0	--	--	--
Products of petroleum and coal....................	0	--	--	--
Rubber products............	0	--	--	--
Leather and leather products..............	0	--	--	--
Primary metal industries...	0	--	--	--
Fabricated metal products..	0	--	--	--
Miscellaneous..............	0	--	--	--
Total...................	10	0	10	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_{14}. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	3	2	1	0	2	1	0
Industrial	0	0	0	0	0	0	0

Table F_{14}. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	0	--	0	--
1948	1	1,400	0	--
1949	0	--	0	--
To July 1950	0	--	0	--

Table G_{14}. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	14	92,835	8
Enlargement or additions to existing plant	1	125	0
Replace existing plant	0	0	0
No project required	7[1]	2,620	2[2]
Undetermined	0	0	0

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] Private untreated sewage from 5 small towns is disposed of by dilution, adequate for the present.

[2] Two industries dispose of their industrial wastes by dilution, adequate for the present.

Table H_{14}. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	15	8
Abatement ordered	0	0
Plans under preparation	0	0
Final plans approved	0	0
Construction awaiting financing	0	0
Under construction	0	0
Status undetermined	0	0

Table I_{14}. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		MAINE MUNICIPALITIES		
Spurwink River	Sanitary	Scarboro-Higgins Beach	125	Add to existing plant
Fore River	Municipal	S. Portland	3,500	New plant
Long Creek	Institutional	State Reform School	150	do
Presumpscot River	Municipal	S. Windham	100	do
do	Institutional	S. Windham Men's Reformatory	200	do
do	Municipal	Westbrook	7,000	do
Highland Lake	do	Bridgton	200	do
Tannery Brook	School	Gorham	200	do
Royal River	Institutional	Pownal State School	1,500	do
do	Municipal	Yarmouth	1,500	do
Atlantic Ocean	do	Portland	77,500	do
do	do	S. Portland	14,000	do
do	Private sewers	Falmouth	700	do
		MAINE INDUSTRY WITH SANITARY SEWAGE ONLY		
Presumpscot River	Machine shop	S. Windham	60	New plant
do	do	do	100	do
do	Small textile plant	Westbrook	125	do
		MAINE INDUSTRIES WITH INDUSTRIAL WASTES		
Presumpscot River	Cotton mill	Westbrook	N	New plant
do	Pulp and paper mill	do	N	do
North Branch River	Beans and corn cannery waste	Gorham	N	do
Royal River	Poultry slaughterhouse	Yarmouth	N	do
do	Dyes and textile processing	do	N	do
do	Fish cannery wastes	do	N	do
Atlantic Ocean	Bean cannery	Portland	N	do
do	Slaughterhouse	do	N	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = Information not available or does not apply.

ANDROSCOGGIN RIVER SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Androscoggin River Sub-Basin is the third largest interstate drainage basin in New England. It has a total area of 3,470 square miles, of which 695 are in New Hampshire and 2,775 are in Maine. The river rises in Maine near the New Hampshire, Canadian and Maine boundaries. It soon enters New Hampshire and flows south about 35 miles before again entering Maine where it flows east then southward. The total length of the river is 200 miles contained within a sub-basin approximately 110 miles long by 55 miles wide at the maximum points.

The Andoscoggin Sub-Basin has the highest average elevations of any river sub-basin on the Atlantic seaboard. The upper regions are mountainous, the central portion is rough and irregular and the lower part of the sub-basin is comparatively low and rolling. Granite is the principal rock formation, covered with an overburden of glacial sand and gravel. About 85 percent of the sub-basin is in forest, and only about 7 percent along the lower river valley is in crop land. There are a large number of lakes in the sub-basin and these account for more than 4 percent of the total area.

The average annual precipitation varies from 33 inches in the mountainous regions to 40 inches near the coast. Summer temperature averages vary from 63^0 to 66^0F. and winter temperature averages vary from 24^0 to 31^0 F., the lower temperatures prevailing at the higher altitudes. The most important tributaries of the river are the Magalloway River and Rangeley Lakes system at the headwaters and the Swift and Little Androscoggin Rivers lower in the sub-basin. Run-off records are kept at several gaging stations and these records indicate the run-off from the total watershed to average 5,170 cubic feet per second.

Economic Development

The farm land in the sub-basin is both above and below the average fertility in Maine. Ready markets and good transportation are available and much of the farming is specialized. The largest source of farm income is from the sale of dairy and poultry products. The value of all farm products sold in 1945 is estimated to have been about $8,300,000.

Industry has become fairly well established in the sub-basin, particularly in the lower portion. Manufacturing is diversified and includes lumber and lumber products, leather and leather products, food and kindred products, textile mill products and paper and allied products. There are an estimated 320 manufacturing establishments employing approximately 25,000 persons. The wages and salaries paid manufacturing employees in 1947 were estimated to be $60,000,000 and the value added to products by manufacture was approximately $112,000,000.

Recreational use of the water resources of the Androscoggin Sub-Basin are not as extensive as in other parts of Maine, but it is, nevertheless, of importance to the economy of the region. There are many sporting and recreation areas and the two best known are the Rangeley Lakes and Poland Springs. Recreational use of the principal streams is handicapped by pollution and water regulation for power development.

Lumbering is still an important activity in which the water resources play an important part. Mining is of minor importance.

The 1950 population of the sub-basin is estimated to be 155,000. Lewiston, Maine, is the largest city with a 1950 population of 41,142. Berlin, N. H., is the largest city in that portion of the sub-basin, having an estimated population of 22,000 in 1950. Four cities, Rumford, Auburn, and Lewiston, Maine, and Berlin, N. H., account for nearly 70 percent of the total population.

Uses of Water Resources

Almost all uses are made of the water resources of the Androscoggin River Sub-Basin. Use for all types of recreation is probably most extensive and use for industrial water supply is very important. The water resources serve as a source for livestock watering, habitat for wildlife, transportation of logs, and shellfish operations. No public water supplies are taken from the surface waters and there is no use of the rivers for navigation purposes.

POLLUTION DATA

Damages to Water Resources from Pollution

Data from which this report is written in part do not indicate what damages have resulted from pollution in the Maine portion of the sub-basin. Other information and the number and kinds of sources of pollution indicate, however, that there has been considerable damage, particularly along the main stem. It has probably been greatest to the recreational uses and shellfish operations. The actual extent of damages from pollution in the Maine portion of the sub-basin must await further information.

In New Hampshire the principal uses of the water resources are for industrial water supply, game fishing, power development and transportation of wastes. The waters are reported to be damaged for game fishing, and below the city of Berlin, it has been indicated that the waters are unsatisfactory for transportation of wastes without nuisance.

Sources of Municipal and Industrial Pollution

There are a total of 58 sources of pollution in the Androscoggin River Sub-Basin. Thirty-eight sources originate from the discharge of sewage from communities and industries having a total population served of 109,700 persons. There are 20 separate sources of industrial waste pollution. These and other data are shown in Tables A_{15} and B_{15}.

Existing Municipal and Industrial Treatment Facilities

Tables C_{15} and D_{15} show that only three of the 58 sources of pollution receive treatment. Two municipalities have provided sewage treatment facilities serving 2,050 persons and one leather processing plant has industrial waste treatment facilities.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Table E_{15} shows the adequacy of existing treatment facilities. None of the existing treatment facilities is providing satisfactory treatment of wastes received.

Very little progress in pollution abatement has been made during the period 1946 through June 1950. As shown by Table F_{15}, one community installed a septic tank in 1946 to treat the domestic sewage from 200 persons.

The requirements for treatment facilities to abate pollution are given in Table G_{15}. Thirty new sewage and 14 new industrial waste treatment facilities are needed as are additions to two existing sewage and one industrial waste treatment plant. No project is required of three small sources of sewage pollution at the present time, and the status of requirements for eight other sources, including three contributed to by 18,500 persons, is undetermined.

The status of the above required projects to abate pollution are summarized in Table H_{15}. No formal action has been taken to abate pollution at any of the 46 sources requiring projects. The status of nine sources of sewage and industrial waste pollution remains to be determined.

Municipalities and Industries Requiring Improvements to Abate Pollution

A list of the sources of pollution requiring improvements to abate pollution is given in Table I_{15}. The names of communities and institutions are given but the names of firms are not given in accordance with the established policies or the laws of several of the New England States.

No projects to abate industrial waste pollution in New Hampshire have been included in Table I_{15}. Such projects are known to be necessary but the types of projects and where they will be required have not been determined. Rather than present inaccurate information, these data have been omitted.

Table A_{15}. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	34[1]	47,050	45,447
Having population data available (Data on pollution load to watercourse incomplete or not available)	4	62,700	Not applicable
Total	38	109,750	—

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] 5 industries discharging sanitary wastes only from 1,917 employees.

Table B_{15}. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	1	670,000
Producing organic wastes	19	Undetermined
Producing inorganic wastes	0	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	20	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_{15}.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	0	0	0
Secondary	2	2	2,050
No treatment	36[1]	--	107,700

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] Includes 5 industries having sanitary sewage only from 1917 employees.

Table D_{15}. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products................	5	0	5	0
Textile mill products............ ...	3	0	3	0
Lumber and wood products.....	0	--	--	--
Paper and allied products.	8	0	8	0
Chemical and allied products................	1	0	1	0
Products of petroleum and coal................	0	--	--	--
Rubber products.	1	0	1	0
Leather and leather products................	2	1	1	0
Primary metal industries..............	0	--	--	--
Fabricated metal products................	0	--	--	--
Miscellaneous.............	0	--	--	--
Totals.............	20	1	20	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_{15}. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	2	0	2	0	0	2	0
Industrial	1	0	1	0	0	1	0

Table F_{15}. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	1	200	0	--
1947	0	--	0	--
1948	0	--	0	--
1949	0	--	0	--
To July 1950	0	--	0	--

Table G_{15}. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	30	88,230	14
Enlargement or additions to existing plant	2	2,450	1
Replace existing plant	--	--	--
No project required	3[1]	570	--
Undetermined	3	18,500	5

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] Two hotels and one town dispose of sewage by dilution, considered satisfactory for the present.

Table H_{15}. Status of treatment works project to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	32	14
Abatement ordered	0	0
Plans under preparation	0	0
Final plans approved	0	0
Construction awaiting financing	0	0
Under construction	0	0
Status undetermined	3	6

Table I_{13}. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		MAINE MUNICIPALITIES		
Androscoggin River	Municipal	Bethel	1,400	New plant
do	School	Rumford Point	110	do
do	Municipal	Rumford	10,000	do
do	do	Mexico	2,400	do
do	do	Dixfield	1,200	do
do	do	Jay	270	do
do	School	Chisholm	300	do
do	Municipal	Livermore Falls	2,300	do
do	do	Lewiston	39,000	do
do	do	Auburn	10,000	do
do	do	Lisbon Falls	2,000	do
do	do	Brunswick	11,400	do
do	do	Topsham	660	do
Swift River	do	Roxbury	70	do
do	do	Mexico	600	do
Webb River	do	Dixfield	250	do
Spears Stream	do	West Peru	100	do
Nezinscot River	do	Buckfield	100	do
do	School	do	150	do
Little Androscoggin River	Municipal	So. Paris	1,700	Add to existing plant
do	do	Oxford	100	New plant
do	do	Mechanic Falls	1,600	do
do	do	Auburn	1,100	do
Pennesseewassee Lake	do	Norway	2,300	do
Taylor Brook	do	Auburn	500	do
Sabbattus River	do	Sabattus	120	do
No Name Brook	do	Lewiston	750	Add to existing plant
		MAIN INDUSTRIES WITH SANITARY SEWAGE ONLY		
Androscoggin River	Woodworking	West Bethel	48	New plant
do	Match company	West Peru	475	do
do	Rayon mill	Brunswick	1,250	do
do	Paper mill	Topsham	50	do
Alder River	Spool company	Lockes Mills	94	do
		MAINE INDUSTRIES WITH INDUSTRIAL WASTES		
Androscoggin River	Paper mill	Rumford	N	New plant
do	do	Livermore Falls	N	do
do	Cannery	do	N	do
do	Paper mill	Chisholm	N	do
do	Woolen mill	Lisbon Falls	N	do
do	Wood fiber	do	N	do
Whitney Brook	Tannery	Canton	N	do
do	Cannery	do	N	do
Little Androscoggin River	Tannery	So. Paris	N	Add to existing plant
do	Woolen mill	Oxford	N	New plant
do	Wood pulp and chemical	Mechanic Falls	N	do
do	Paper company	Hacketts Mills	N	do
Bog Brook	Canning plant	West Minot	N	do

See footnotes at end of table.

Table I_{13} Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
Sabattus River	Floor coverings	Lisbon	N	New plant
do	Woolen plant	do	N	do
		NEW HAMPSHIRE MUNICIPALITIES		
Androscoggin River	Municipal	Berlin	8,000	New plant
do	do	Gorham	2,500	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N=Information not available or does not apply.

KENNEBEC AND SHEEPSCOT RIVERS SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Kennebec River Sub-Basin is the third largest in Maine and drains 5,970 square miles of the west central part of the State. The sub-basin extends north and south about 150 miles and the maximum width is about 80 miles. Sixty miles of the northwest divide of the sub-basin form the international boundary line with Canada. The Sheepscot is a small river draining the 288 square miles immediately east of the Kennebec Sub-Basin.

The northern half of the sub-basin is rugged terrain with numerous mountain peaks of 3,000 to 4,000 feet above mean sea level. In the lower half the topography becomes more rolling and levels off as the coastal plain is reached. Rock formation is predominantly granite with some deposits of shale and sandstone. The overburden is sandy and not well suited to agriculture, only 15 percent of the sub-basin being in cleared farmland.

Annual precipitation in the upper parts of the sub-basin averages about 36 inches and in the lower parts it averages nearly 46 inches. Summer temperatures vary from 61° to 66° F. and winter averages vary from 13° to 24°, the lower temperatures prevailing in the northern portions of the sub-basin.

The principal tributaries of the Kennebec are the Moose, Dead, Sandy and Sebasticook Rivers. The average annual run-off from the sub-basin is approximately 10,640 cubic feet per second.

Economic Development

The farmland in the sub-basin is not so fertile as in other parts of Maine, but agriculture is nevertheless rather widely practiced in the lower parts of the sub-basin. Farming is somewhat handicapped by lack of local markets. Farm revenue is mainly derived from the sale of dairy and poultry products with some income from woodlots. The value of all farm products sold in the sub-basin in 1945 is estimated to have been more than $12,000,000.

Industry has been fairly well developed in the sub-basin and income from this source ranks about third among the other river sub-basins in Maine. Manufacturing is rather well diversified and includes manufacture of shoes, hardware, pulp and paper, the processing of textiles, canning of foods and fish, etc. There are approximately 300 manufacturing establishments in the sub-basin that employed an average of 23,500 persons in 1947. The salaries and wages paid all manufacturing employees during that year was approximately $45,500,000 and the value added to products by manufacture was some $89,700,000.

The Kennebec River Sub-Basin is a favorite recreational area for hunters, fishermen, tourists and summer residents. Boating, hunting and bathing opportunities attract many persons, while others are drawn to the area by its scenic beauty.

From preliminary releases of the 1950 census, the population of the sub-basin is estimated to be 175,000. There are six communities having populations over 5,000 of which Augusta, the capital of Maine, is the largest with a 1950 population of 20,900.

Uses of the Water Resources

All legitimate uses are made of the water resources of the Kennebec River Sub-Basin. Use for public water supply is most important and use for industrial water supply is extensive. There is widespread use for all types of recreational activity. Transportation of logs to the pulp mills is an important use of the waters as is livestock watering. In the lower areas of the sub-basin the waters are used for navigation, commercial fishing, and shellfish propagation. In some areas the streams are a source of water supply for fire protection.

POLLUTION DATA

Damages to Water Resources from Pollution

The data available do not indicate the extent to which damages have resulted from pollution or to what water uses. However, from the number of sources requiring projects to abate pollution, it is concluded that there has been damage to the water resources from pollution. The amounts of sewage and industrial waste pollution discharged without treatment indicate that most of the water uses are hampered by pollution at various locations within the sub-basin.

Sources of Municipal and Industrial Pollution

Tables A_{16} and B_{16} summarize the number of sources of sewage and industrial waste pollution. Of the total of 120 separate sources of pollution, 75 discharge sewage from and have a connected population of nearly 101,000 persons. Forty-five discharge organic industrial wastes. Industrial wastes are principally from the processing of textiles, canning of foods and the manufacture of pulp and paper.

Existing Municipal and Industrial Treatment Facilities

Of the 75 sources of sewage pollution, only four receive treatment. Each receives primary treatment and all four serve a total of 1,000 persons. The other 75 sources of sewage pollution serving almost 100,000 people discharge wastes untreated. Treatment facilities have been provided at only two of the 45 sources of organic industrial waste pollution.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Table E_{16} shows the adequacy of existing treatment facilities. Four communities provide primary treatment for their wastes. Three of these existing facilities are adequate. The other treatment plant is overloaded. The adequacy of the two industrial waste treatment plants has not been determined.

The septic tanks provided for treating domestic sewage from 500 persons residing in Clinton were constructed in 1947. The dates of installation of the industrial waste treatment units and the septic tanks at North Anson, Georgetown and New North Portland are not known. These facilities represent the only progress in pollution abatement in the sub-basin to date.

The requirements in numbers for sewage and industrial waste treatment plants are given in Table G_{16}. Of the total of 120 separate sources of pollution, 57 sources of sewage and 38 sources of industrial waste pollution require new plants and enlargements or additions are required at one existing sewage plant and two industrial waste treatment facilities. No project is required for 21 sources of pollution, 17 sewage and 4 industrial waste pollution, at the present time, and the needs at one source of industrial pollution have not been determined.

No action has yet been taken to abate pollution in the sub-basin as shown by Table H_{16}.

Table I_{16} is a list of the sources of sewage and industrial waste pollution requiring improvements for abatement of pollution. The names of communities, schools and institutions are given but the names of firms omitted in accordance with the policies or laws of several of the New England States.

Tables A_{16} through I_{16} follow.

Table A_{16}. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	68[1]	75,521	74,894
Having population data available (Data on pollution load to watercourse incomplete or not available)	7	25,430	Not applicable
Total	75	100,951	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] Includes 16 industries having sanitary sewage only from 2946 employees.

Table B_{16}. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	0
Producing organic wastes	45	Undetermined.
Producing inorganic wastes	0	Not applicable.
Producing wastes of undetermined type	0	Undetermined.
Total	45	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_{16}.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	4	4	1,005
Secondary	0	0	0
No treatment	71[1]	0	99,946

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] Includes 16 industries discharging sanitary sewage only from 2946 employees.

Table D_{16}. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products	18	0	18	0
Textile mill products	18	1	17	0
Lumber and wood products	0	--	--	--
Paper and allied products	6	0	6	0
Chemical and allied products	0	--	--	--
Products of petroleum and coal	0	--	--	--
Rubber products	0	--	--	--
Leather and leather products	2	1	1	0
Primary metal industries	0	--	--	--
Fabricated metal products	0	--	--	--
Miscellaneous	1	0	1	0
Totals	45	2	43	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_{16}. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	4	3	1	0	3	1	0
Industrial	2	0	0	2	0	0	2

Table F_{16}. Progress in pollution abatement[1]

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	1	500	0	--
1948	0	--	0	--
1949	0	--	0	--
To July 1950	0	--	0	--

[1] Dates of installation of two industrial waste treatment facilities and septic tanks in three villages are not available.

Table G_{16}. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	57	97,291	38
Enlargement or additions to existing plant	1	530	2[2]
Replace existing plant	0	0	0
No project required	17[1]	3,130	4[3]
Undetermined	0	0	1

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] 14 towns and industries with sanitary sewage only, dispose of sewage by dilution; satisfactory disposal for the present.

[2] 2 industrial waste treatment plants of undetermined design and operation, known to require additions.

[3] 4 industries with no waste treatment dispose of wastes by dilution, a satisfactory method for the present.

Table H_{16}. Status of treatment works projects to abate pollution, September, 1950

Status of project	Number	
	Municipal	Industrial
No formal action	58	40
Abatement ordered	0	0
Plans under preparation	0	0
Final plans approved	0	0
Construction awaiting financing	0	0
Under construction	0	0
Status undetermined	0	1

Table 14. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		MAINE MUNICIPALITIES		
Moose River	Municipal	Jackman	700	New plant
Kennebec River	do	Madison	2,000	do
do	do	Anson	375	do
do	do	Skowhegan	5,000	do
do	do	Fairfield	700	do
do	Institutional	do	100	do
do	Municipal	Waterville	11,330	do
do	do	Winslow	1,670	do
do	do	Augusta	15,500	do
do	Hospital	do	2,000	do
do	Municipal	Hallowell	2,000	do
do	do	Farmingdale	700	do
do	do	Gardiner	5,000	do
do	do	Randolph	325	do
do	do	Richmond	1,500	do
do	do	Bath	10,000	do
Carrabasset River	do	Kingfield	900	do
Mill Stream	School	North Anson	250	do
Getchell Brook	Municipal	Anson	125	do
Sandy River	do	Farmington	3,600	do
do	do	New Sharon	100	do
Wilson Stream	do	Wilton	1,500	do
Mill Stream	do	Norridgewock	200	do
Holland Brook	do	Waterville	170	do
Messalonskee Stream	do	Oakland	1,500	do
do	do	Waterville	5,180	do
Hayden Brook	do	do	3,420	do
Sebasticook River	do	Hartland	200	do
do	do	Pittsfield	2,200	do
do	do	Clinton	530	Add to existing plant
do	do	Winslow	1,380	New plant
E. Branch Sebasticook River	do	Dexter	2,000	do
do	do	Corinna	700	do
do	do	Newport	1,300	do
Farnham Brook	do	Pittsfield	1,000	do
Outlet Stream	do	Vassalboro	400	do
Bond Brook	do	Augusta	500	do
Cobbesseecontee Stream	do	Gardiner	2,000	do
Mill Stream	do	Winthrop	400	do
Wilson Stream	do	N. Monmouth	90	do
do	Municipal	Monmouth Ctr.	20	do
Togus Stream	Institutional	Chelsea	2,000	do
Sheepscot River	Municipal	Wiscasset	300	do
do	do	Georgetown	100	do
Damariscotta River	do	Damariscotta	300	do
do	do	Newcastle	200	do
Atlantic Ocean	do	Southport	1,200	do
do	do	Boothbay Harbor	3,000	do

See footnotes at end of table.

Table I_{14}. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950—Continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		MAINE INDUSTRIES WITH SANITARY SEWAGE ONLY		
Kennebec River	Shoe co.	Norridgewock	250	New plant
do	Woolen mill	Richmond	150	do
do	Shipyard	Bath	600	do
do	Hardware mfg.	do	400	do
Wilson Stream	Shoe factory	Wilton	216	do
do	Wood products	do	40	do
E. Branch Sebasticook River	Machine shop	Dexter	275	do
Lake Annabessacook	Floor coverings	Winthrop	125	do
Maranacook L.	Paint company	do	90	do
Sheepscot River	Power co.	Wiscasset	50	do
		MAINE INDUSTRIES WITH INDUSTRIAL WASTES		
Kennebec River	Paper mill	Madison	N	New plant
do	do	do	N	do
do	Vegetable cannery	Norridgewock	N	do
do	do	do	N	do
do	Woolen mill	Skowhegan	N	do
do	Spinning mill	do	N	do
do	Fiber mill	Fairfield	N	do
do	Woolen mill	do	N	do
do	Cotton mill	Waterville	N	do
do	Pulp and paper	Winslow	N	do
do	do	Augusta	N	do
do	Textile and dyes	do	N	do
do	Canning works	Bath	N	do
Sandy River	Corn cannery	Farmington	N	do
do	Cannery	do	N	do
do	do	do	N	do
do	do	New Sharon	N	do
Temple Stream	do	W. Farmington	N	do
Wilson Stream	Woolen mill	Wilton	N	do
do	Cannery	do	N	do
Lemon Stream	do	Starks	N	do
Messalonskee Stream	Woolen mill	Winterville	N	do
do	Ice cream plant	do	N	do
Sebasticook River	Vegetable processing	Hartland	N	do
do	Tanning plant	do	N	do
do	Woolen mill	Pittsfield	N	do
do	do	do	N	do
do	Tanning	Clinton	N	Add to existing plant
do	Woolen mill	do	N	New plant
E. Branch Sebasticook River	do	Dexter	N	do
do	do	do	N	do
do	Vegetable processing	Corrina	N	do
do	Woolen mill	do	N	do
do	do	Newport	N	do
Outlet Stream	do	Vassalboro	N	do
Cobbosseecontee Stream	Pulp mill	Gardiner	N	do

See footnotes at end of table.

Table I_{16}. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950--Continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
Cobbesseecontee Stream	Coated paper mill	Gardiner	N	New plant
Mill Stream	Dye and textile	Winthrop	N	do
Wilson Stream	Felt company	N. Monmouth	N	Add to existing plant
do	Canning company	Monmouth Ctr.	N	New plant

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.
**N = information not available or does not apply.

PENOBSCOT RIVER AND COASTAL STREAMS SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Penobscot River has the largest drainage sub-basin in Maine and included in this sub-basin are the Union, Medomak, St. George, Megunticook and Passagassawamkeag Rivers, Mill Brook and several unnamed streams that discharge directly into the Atlantic Ocean. The Penobscot River drains an area of 8,570 square miles, and the coastal streams have a total watershed of about 1,050 square miles. The greatest length of the Penobscot from the headwaters to mouth is nearly 250 miles. The second longest river in this sub-basin group is the Union River which flows a distance of 40 miles.

The topography of the area is fairly uniform and is interspersed with rolling hills and mountains of low elevation. There are numerous large lakes in the sub-basin that comprise nearly five percent of the total area. Nearly 90 percent of the sub-basin is in forest or cut-over woodland and only about five percent is in tilled farm land. Rock formation is mainly shale, slate and schists, with some granite and occasional iron and lead pyrite deposits.

Precipitation varies according to distance from the ocean, being about 37" along the western rim of the sub-basin and about 43" along the coastal region, with an average for the sub-basin of nearly 40". Summer temperatures along the western rim average 60°F. and average 65°F. along the coast. Winter averages in these two general areas vary from 12° to 22°F., being highest near the ocean.

The important tributaries to the Penobscot River are the East and West Branches, Mattawamkeag and Piscataquis Rivers. The average annual discharge from the Union River has been approximately 890 cubic feet per second, and for the whole Penobscot River and Coastal Streams Sub-Basin it is estimated to be about 17,100 cubic feet per second.

Economic Development

Preliminary releases by the Bureau of the Census indicate the sub-basin to have an estimated 1950 population of 207,000--an increase over the 1940 figures. Most of the population is concentrated in the eastern and southern areas. There are 11 communities having populations of 2,500 or over--the largest being Bangor with an estimated 1950 population of 35,000.

Only one-eighth of the sub-basin is in farmland and of this, one-third is in woodland. Livestock and forest products are the principal sources of farm income. The value of all farm products sold in 1945 is estimated to be $18,000,000.

In the past, industry was generally confined to processing the forest resources of the sub-basin. In recent years industry has become more diversified and now includes food-processing plants, textile mills, and miscellaneous manufacturing activities as well as the manufacture of products from wood. There are an estimated 17,000 manufacturing employees that had a combined estimated income of $36,800,000 in 1947. The value added to products by manufacture during this period was approximately $67,000,000.

The Penobscot River and Coastal Streams Sub-Basin combines nearly all of the essential requirements for outdoor recreation. The resources have been rather widely used for these purposes and the area is quite popular with vacationists. There are extensive forests abounding in game, numerous lakes and streams affording excellent fishing, and a rugged coastline complete with picturesque islands. Of the areas developed for recreation, the colony at Bar Harbor is best known.

The lower part of the sub-basin is interconnected with an adequate highway system and the principal cities by several railroads and airlines.

Uses of Water Resources

Practically every normal use is made of the water resources of the sub-basin. The most important single use is for public water supply and the principal economic uses are for all types of water recreation, commercial fishing, industrial process supplies, and shellfish propagation. Other uses are for wildlife, livestock watering and navigation.

There has been an appreciable development of hydroelectric power, mostly by industry at two sites and by one utility company at another. There are many undeveloped power sites remaining for which there is as yet no market.

POLLUTION DATA

Damages to Water Resources from Pollution

Pollution from sewage and poultry slaughter-house wastes has damaged use of the Medomak River for public water supply, commercial fishing, shellfish operations and recreational bathing.

There have been no damages from pollution of the St. George River up to the present time, nor have any been reported for the Megunticook River. The Passagassawamkeag River is used for navigation purposes only, and there have been no damages to it from pollution.

Areas at the mouths of the Union River and Mill Brook have been closed to clam digging but there have been no other damages. There are several unnamed coastal streams put to no general use other than to transport a small amount of pollution to the ocean. There are 12 sources of pollution from Friendship to Bar Harbor, including Penobscot Bay, that are discharged directly into the ocean and are reported to contribute no damage to the normal uses of these coastal waters for commercial fishing, shellfish propagation, game fishing and navigation.

Although the main stem of the Penobscot River receives an appreciable amount of domestic sewage pollution, the only damages reported are against use for public water supply from South Lincoln to the confluence with the Piscataquis River, a stretch of some six miles.

The Piscataquis River is damaged downstream from Guilford to the confluence with the Penobscot, a distance of 40 miles, for use as public or industrial water supply and for recreational bathing. The Sebec River, a tributary of the Piscataquis, is damaged at Milo for use downstream as a wildlife habitat and for game fishing.

The Bagaduce River, a small stream that enters the Penobscot near the mouth, has been damaged by sewage from Castine and is unsuitable downstream for commercial fishing, shellfish propagation, and recreational bathing.

There are numerous sources of pollution scattered throughout the Penobscot River Sub-Basin that are not as yet considered to result in any damages to normal water uses.

Sources of Municipal and Industrial Pollution

Data on the sources of municipal and industrial pollution are summarized in Tables A_{17} and B_{17}. Fifty-nine communities, five institutions and 13 manufacturing plants with a total contributing population of 106,000 persons discharge sewage and only two of these sources provide treatment. Forty-one industrial plants producing organic wastes discharge these without treatment and one plant producing inorganic wastes provides unsatisfactory treatment before disposal.

Existing Municipal and Industrial Treatment Facilities

Tables C_{17} and D_{17} show the data on the existing treatment facilities. Of the 77 sources of sewage pollution only two sources, serving 3,900 persons, receive treatment. The sewage from 102,200 persons is discharged without treatment through 75 sources. One source of inorganic industrial wastes receives treatment and 41 sources have not treatment facilities.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Table E_{17} shows that of the total of 119 sources of sewage and industrial waste pollution, only three waste treatment plants have been provided: two for institutional sewage and the other for inorganic industrial wastes,

Table A_{17}. Sources of pollution, municipal

Municipal-ities*	Sources of pollution (in number of munici-palities)	Population served by sewerage system	Amount of pollution discharged to water-course (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	66[1]	56,260	55,630
Having population data available (Data on pollution load to watercourse incomplete or not available)	11	49,900	Not applicable
Total	77	106,160	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] Includes 13 industries discharging sanitary wastes only; 1,640 people employed.

all of which provide an inadequate degree of treatment.

The requirements for municipal and industrial waste treatment facilities are given in summary form in Table G_{17}. A total of 86 new treatment works are needed, 62 for the treatment of sewage from 90,000 persons and 24 for the treatment of industrial wastes. Two existing sewage plants serving 3,900 persons and one existing industrial waste plant require enlargements or additions. No project is required for 13 sources of sewage pollution from 12,000 persons or for two sources of industrial wastes now being disposed of by dilution, a method considered satisfactory for the present. The needs of 15 sources of industrial waste pollution have not yet been determined.

Table H_{17} shows that of the 89 sources of pollution for which improvements to abate pollution are required, no action has been taken.

Table B_{17}. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	0
Producing organic wastes	41	Undetermined.
Producing inorganic wastes	1	Not applicable.
Producing wastes of undetermined type	0	Undetermined.
Total	42	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Municipalities and Industries Requiring Improvements to Abate Pollution

The list of sources of sewage and industrial waste pollution requiring improvements is given in Table I_{17}. The names of municipalities and institutions are given, but the names of firms are excluded in accordance with the policies or laws of several of the New England States. Instead, the types of wastes, locations of sources, and receiving streams are given.

Table C_{17}.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	2	2	3,900
Secondary	0	0	0
No treatment	75[1]	0	102,260

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] Includes 13 industries discharging sanitary sewage only; 1,640 employees.

Table D_{17}. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products	24	0	24	0
Textile mill products	9	0	9	0
Lumber and wood products	1	0	1	0
Paper and allied products	7	0	7	0
Chemical and allied products	0	--	--	--
Products of petroleum and coal	0	--	--	--
Rubber products	0	--	--	--
Leather and leather products	0	--	--	--
Primary metal industries	1	1	0	0
Fabricated metal products	0	--	--	--
Miscellaneous	0	--	--	--
Total	12	1	41	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_{17}. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	2	0	2	0	0	0	2
Industrial	1	0	1	0	0	1	0

Table F_{17}. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	0	--	0	--
1948	0	--	0	--
1949	0	--	0	--

Table G_{17}. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	62	90,260	24
Enlargement or additions to existing plant	2	3,900	1
Replace existing plant	0	0	0
No project required	13[1]	12,000	2[2]
Undetermined	0	0	15

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] 13 towns and industries with sanitary sewage only dispose of wastes by dilution, satisfactory for the present.

[2] 2 plants dispose of industrial wastes by dilution, satisfactory for the present.

Table H_{17}. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	64	25
Abatement ordered	0	0
Plans under preparation	0	0
Final plans approved	0	0
Construction awaiting financing	0	0
Under construction	0	0
Status undetermined	0	15

Table I_{17}. Project list - municipalities and industries requiring improvements for abatement of pollution,* September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		MAINE MUNICIPALITIES		
Medomak River	Municipal	Waldoboro	600	New plant
St. George River	do	Warren	100	do
do	do	Thomaston	1,600	do
do	Prison	do	550	do
Atlantic Ocean	Municipal	Camden	2,500	do
Penobscot Bay	do	Belfast	4,000	do
Mill Brook	do	Searsport	200	do
Penobscot River	do	E. Millinocket	1,600	do
do	School	Medway	200	do
do	do	Mattawamkeag	250	do
do	Municipal	W. Enfield	160	do
do	do	Howland	200	do
do	Indian reservation	Old Town	500	do
do	Municipal	Milford	850	do
do	do	Old Town	4,500	do
do	do	Bradley	100	do
do	School	Orono	130	do
do	Municipal	do	1,000	do
do	do	Veazie	350	do
do	Hospital	Bangor	1,500	do
do	do	do	400	do
do	Municipal	do	10,000	do
do	do	Brewer	5,000	do
do	Air force	Bangor	2,000	do
do	Municipal	Winterport	800	do
do	do	Bucksport	2,000	do
Millinocket Stream	do	Millinocket	6,140	do
W. Branch Mattawamkeag River	School	Island Falls	400	do
Webb Brook	do	Patten	400	do
Baskahegan Str.	Municipal	Danforth	350	do
Mattakeunk Str.	School	Lee	220	do
Mattanawcook Stream	Municipal	Lincoln	3,500	do
Piscataquis River	do	Guilford	650	do
do	do	Dover-Foxcroft	3,200	do
do	do	Howland	1,500	do
Carleton Stream	do	Sangerville	500	do
Sebec River	do	Milo	1,200	do
Pleasant River	do	Brownville Jct.	1,200	do
do	do	Brownville	175	do
do	do	Milo	200	do
Stillwater River	Municipal	Old Town	500	do
do	School	Orono	3,600	Add to existing plant
do	Municipal	do	1,200	New plant
Kenduskeag Stream	Institutional	Bangor	40	do
do	Municipal	do	14,500	do
Sourdabscook Stream	do	Hampden	450	do

See footnotes at end of table.

Table I_{17}. Project list - municipalities and industries requiring improvements for abatement of pollution,* September 1950 - continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
Reeds Brook	Municipal	Hampden	250	New plant
Marsh Stream	School	Frankfort	100	do
Bagaduce River	Municipal and school	Castine	2,000	do
Mill Brook	School	Blue Hill	300	Add to existing plant
Unnamed Str.	Municipal	do	75	New plant
Union River	do	Ellsworth Falls	200	do
do	do	Ellsworth	2,800	do
Hog Bay	School	E. Franklin	120	do
Atlantic Ocean	Municipal	Rockland	6,000	do
MAINE INDUSTRIES WITH SANITARY SEWAGE ONLY				
Medomak River	Button factory	Waldoboro	60	New plant
Megunticook River	Felt company	Camden	50	do
Penobscot River	Wood products	S. Lincoln	100	do
Mattawamkeag River	do	Mattawamkeag	200	do
Piscataquis River	R. R. shops	Sebec River	250	do
Carleton Str.	Woolens	Sangerville	150	do
Sebec River	R. R. shops	Derby	300	do
Pleasant River	Wood products	Brownville	150	do
do	do	do	40	do
MAINE INDUSTRIES WITH INDUSTRIAL WASTES				
Medomak River	Poultry	Waldoboro	N	New plant
St. George River	Woolens	Warren	N	do
do	Sea food cannery	Thomaston	N	do
Megunticook River	Woolens	Camden	N	do
do	Textile mill	do	N	do
do	Woolen mill	do	N	do
Passagassawamkeag River	Poultry	Belfast	N	do
do	Sardine plant	do	N	do
Mill Brook	Fertilizer	Searsport	N	Add to existing plant
Penobscot River	Pulp and news print	E. Millinocket	N	New plant
do	Woolen mill	Old Town	N	do
do	Wood pulp	do	N	do
do	Pulp and paper	Brewer	N	do
do	do	Bucksport	N	do
Millinocket Str.	Pulp and news print	Millinocket	N	do
W. Branch Mattawamkeag River	Creamery	Island Falls	N	New plant
Mattanawcook Stream	Pulp and paper	Lincoln	N	do
Piscataquis River	Woolen mill	Guilford	N	do
do	do	Dover-Foxcroft	N	do
do	Paper mill	Howland	N	do
Carleton Str.	Woolen mill	Sangerville	N	do
Kewduskeag Str.	Wool scouring	Bangor	N	do
Marsh Stream	Canning	Brooks	N	do
Winslow Stream	do	S. Penobscot	N	do
Atlantic Ocean	15 fish packing plants	Rockland	N	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = Information not available or does not apply.

NORTH MAINE COASTAL STREAMS SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The North Maine Coastal Streams Sub-basin is drained by the Narragaugus, Harrington, Pleasant, Chandler and Machias Rivers. The Machias River is the principal river of the sub-basin. The total drainage area is about 1,020 square miles, of which the Machias River and its principal tributary, the East Machias River, drain 784 square miles. The Machias is the longest river and flows southeasterly about 50 miles before entering the Atlantic Ocean.

The land is of low and irregular topography with hills occasionally rising to 1,000 feet. The rock formation is chiefly granite and gneiss covered with sand and gravel and frequent deposits of metal pyrites. The soils in the area are not well suited to farming. More than 90 percent of the sub-basin is in forest or cut-over soft woodlands. There are many lakes that cover nearly five percent of the drainage area.

The annual precipitation averages about 42 inches with the greatest amounts falling in the Pleasant River Sub-Basin. Winter temperature averages vary from 18° to 24°F. and summer temperatures from 58° to 65° F., the lower temperatures being recorded at the more distant points from the ocean. Available records indicate run-off over many years to average about 2.09 second feet per square mile, or an annual discharge of about 2,130 cubic feet per second for the sub-basin.

Economic Development

The fertility of the soil in the sub-basin is not well suited to agriculture. Very little of the area is in farm land and the principal source of income is derived from the blueberry crop. The farm woodlot also contributes a measure of the farm revenue.

The processing and canning of blueberries and seafoods are the main manufacturing pursuits. An abundance of pulp-wood is available, but lack of transportation and other difficulties have hampered the expansion of this industry.

The population of the sub-basin has shown a steady decline since 1930. The present 1950 population is estimated to be less than 20,000. Machias is the largest community, having a 1950 population of 2,066.

The sub-basin area has almost all the attractions necessary for recreational development. There has been some development of recreation along the ocean and the more accessible inland lakes and the wildlands have for some time been attractive to sportsmen.

Uses of Water Resources

Inasmuch as the area is not well developed and declining somewhat, there is not extensive use made of the water resources. The largest use is for shellfish and commercial fishing operations. The Machias River is used for public water supply at one point and for industrial water supply at Whitneyville and Machias. The Narragaugus River is used for navigation purposes below the village of Milbridge.

POLLUTION DATA

Damages to Water Resources from Pollution

There have been no damages recorded for the limited uses made of the water resources of the North Maine Coastal Streams.

Sources of Municipal and Industrial Pollution

Tables A_{18} and B_{18} show that pollution from sewage is contributed by 11 community sewerage systems or private sewers serving 1900 persons, four schools and by two industries employing 210 persons. Ten manufacturing plants discharge untreated process wastes into the waters of the sub-basin. Most of the sewage pollution is from private sewers in small villages.

Existing Municipal and Industrial Treatment Facilities

Tables C_{18} and D_{18} show that three of the 17 sources of sewage pollution receive treatment in septic tanks. None of the 10 industrial sources of pollution receive treatment before discharge.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Table E_{18} reveals that only three sources of sewage pollution (2 manufacturing plants and 1 school) receive treatment and that the degree of treatment provided is unsatisfactory.

Requirements for municipal and industrial waste treatment facilities are given in Table G_{18}. Fourteen new sewage treatment facilities to serve 2,230 persons and 10 new industrial waste treatment plants are needed to be constructed. The three existing septic tanks serving 360 persons require additions to provide adequate treatment.

Table H_{18} indicates that no formal action has been taken on projects to abate pollution at the 27 known sources of sewage and industrial waste pollution.

Table A_{18}. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	17[1]	2,590	2,340
Having population data available (Data on pollution load to watercourse incomplete or not available)	0	0	Not applicable
Total	17	2,590	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] 2 industries discharge sanitary wastes only, 210 employees.

Municipalities and Industries Requiring Improvements to Abate Pollution

A list of the sources of sewage and industrial waste pollution requiring improvements to abate pollution in this sub-basin is given in Table I_{18}. The names of communities and schools are given, but the names of firms are excluded in accordance with the policies or laws of several of the New England States. Instead, the types of industrial wastes, locations and receiving streams are given.

Table B_{18}. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	0
Producing organic wastes	10	Undetermined.
Producing inorganic wastes	0	Not applicable.
Producing wastes of undetermined type	0	Undetermined.
Total	10	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_{18}.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	3[1]	3[2]	360
Secondary	0	0	0
No treatment	14	0	2,230

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] Includes 2 industries having only sanitary sewage from 210 employees.

[2] Septic tanks only.

Table D_{18}. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having: Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products................	10	0	10	0
Textile mill products................	0	--	--	--
Lumber and wood products................	0	--	--	--
Paper and allied products................	0	--	--	--
Chemical and allied products................	0	--	--	--
Products of petroleum and coal................	0	--	--	--
Rubber products...........	0	--	--	--
Leather and leather products................	0	--	--	--
Primary metal industries..............	0	--	--	--
Fabricated metal products................	0	--	--	--
Miscellaneous............	0	--	--	--
Total..................	10	0	10	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_{18}. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to: Capacity: Satisfactory	Capacity: Unsatisfactory	Capacity: Undetermined	Operation: Satisfactory	Operation: Unsatisfactory	Operation: Undetermined
Municipal	3	0	3	0	0	3	0
Industrial	0	0	0	0	0	0	0

Table F_{18}. Progress in pollution abatement

Year	Municipal: Plants completed	Municipal: Design population	Industrial: Plants completed	Industrial: Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	0	--	0	--
1948	0	--	0	--
1949	0	--	0	--

Table G_{18}. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	14	2,230	10
Enlargement or additions to existing plant	3	360	0
Replace existing plant	0	0	0
No project required	0	0	0
Undetermined	0	0	0

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

Table H_{18}. Status of treatment works projects to abate pollution, September, 1950

Status of project	Number	
	Municipal	Industrial
No formal action	17	10
Abatement ordered	--	--
Plans under preparation	--	--
Final plans approved	--	--
Construction awaiting financing	--	--
Under construction	--	--
Status undetermined	--	--

Table I_{18}. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
MAINE MUNICIPALITIES				
Narraguagus River	Municipal	Cherryfield	60	New plant
do	do	Milbridge	350	do
do	School	do	150	do
Harrington River	Municipal	do	100	do
do	School	do	150	Add to existing plant
Pleasant River	Municipal	Columbia Falls	50	New plant
do	School	do	70	do
do	Municipal	Addison	30	do
Chandler River	do	Jonesboro	30	do
Machias River	do	Whitneyville	40	do
do	do	Machias	1,100	do
do	do	Machiasport	10	do
Middle River	do	Machias	100	do
E. Machias River	do	E. Machias	40	do
do	School	do	100	do
MAINE INDUSTRIES WITH SANITARY SEWAGE ONLY				
Machias River	Sawmill	Whitneyville	100	Add to existing plant
do	Manufacturing co.	Machias	110	do

See footnotes at end of table.

Table I_{18}. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950—Continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		MAINE INDUSTRIES WITH INDUSTRIAL WASTES		
Narraguagus River	Blueberry cannery	Cherryfield	N	New plant
do	do	do	N	do
do	Sardine cannery	Milbridge	N	do
do	Sardine and clam cannery	do	N	do
do	Clam cannery	do	N	do
Pleasant River	Sardine cannery	Addison	N	do
Chandler River	Clam cannery	Jonesboro	N	do
Machias River	Slaughterhouse	Machias	N	do
do	Sardine cannery	Machiasport	N	do
do	do	do	N	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = Information not available or does not apply.

ST. CROIX RIVER SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The St. Croix River is formed by the confluence of the East Branch and the West Branch, both of which have their origin in large lakes. The total length of the river, including both branches, is 100 miles of which nearly three-fourths forms the international boundary line with Canada. The drainage area of the sub-basin in Maine is about 1, 100 square miles.

Elevations in the sub-basin are generally low. There are numerous lakes throughout the watershed, of which the Grand Lakes system is a part. Lakes account for more than nine percent of the watershed area in Maine; about 10 percent is in pasture or crops, and the remainder is in heavy forest or cut-over woodland. Bedrock formation is almost entirely granite and limestone. The only soil suitable for agriculture lies along the lower reaches of the river.

The average annual precipitation is about 41 inches with slightly more rainfall occurring during the fall months. The average summer temperature is near 65°F. and winter temperatures average 16° to 20°F. There are only two large tributaries to the St. Croix River--the West Branch and the upper St. Croix or East Branch. The average run-off from the Maine portion of the sub-basin during 27 years of record has averaged about 1, 775 cubic feet per second.

Economic Development

The sub-basin includes only four communities of over 1, 000 population, the largest being Calais with an estimated 1950 population of 4, 000. The 1950 population of the sub-basin is estimated to be 12, 500 and the preliminary releases of the 17th Census indicates a small decrease in population since 1940. Seventy-five percent of the population live in the coastal commuities of Eastport, Calais and Lubec.

Agriculture is on a limited scale in the sub-basin because the soil is not well suited to farming, and only about 10 percent of the sub-basin is in farmland. Dairy products are the principal source of farm income which, in 1945, is estimated to have been less than a million dollars.

The principal source of income in the sub-basin is derived from the canning and processing of sea foods. There is also one sulfite pulp and paper mill. These manufacturing processes are the largest sources of employment and are confined almost entirely to the coastal towns. An estimated 2, 280 manufacturing employees earned an estimated total of $4, 500, 000 and added value to products by manufacture estimated to be $11, 000, 000.

Lumbering is an important activity in the sub-basin with pulpwood being the principal product. The St. Croix Sub-Basin encompasses the greater part of the Grand Lake Stream area and is a famous wildlife region. There has not been much recreational development in the sub-basin because of its proximity to nearby popular seashore resorts.

Uses of Water Resources

The principal uses of the water resources of the sub-basin are for commercial and game fishing, all types of water recreation activities, and navigation. There is also one section of the St. Croix River used as a source of emergency public water supply by Calais. The public water supplies are all derived from ground water sources, except at Eastport where the water supply is taken from Little River. The St. Croix River has also been developed for hydroelectric power generation.

POLLUTION DATA

Damages to Water Resources from Pollution

Under present conditions there have been no significant damages to the water resources of the St. Croix Sub-Basin from pollution originating in Maine. Almost all sources of pollution are confined to the coastal area from Calais to Lubec. The fairly recent influx of seafood processing plants in the coastal towns is causing an increasing problem that in the not too distant future may require a solution to abate harbor pollution. The Maine authorities have considered the water resources of the sub-basin to be suitable for the normal uses at the present time. Not much is known of pollution that may be discharged in the Canadian portion of the sub-basin.

Sources of Municipal and Industrial Pollution

The sources of municipal and industrial pollution are summarized in Tables A_{19} and B_{19}. Four communities served by municipal sewerage systems discharge the domestic sewage from 10,400 persons without treatment. Three small communities with a combined population of 230 also discharge untreated domestic sewage from private outlets. There are 29 sources of industrial waste pollution discharging directly to watercourses without treatment.

Existing Municipal and Industrial Treatment Facilities

There are no municipal sewage or industrial waste treatment plants in the sub-basin. Tables G_{19} and D_{19} show the number of sources of this type of pollution that is being discharged untreated.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Table E_{19} shows that, while there are no existing treatment facilities, three small villages and 26 manufacturing plants dispose of wastes by dilution which is considered satisfactory disposal for the present.

Table A_{19}. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	4	10,400	10,400
Having population data available (Data on pollution load to watercourse incomplete or not available)	3	230	Not applicable
Total	7	10,630	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

Table G_{19} shows the requirements for municipal and industrial waste treatment plants in the sub-basin. The four large municipalities require the construction of new treatment works. No action is to be required of three villages that discharge domestic sewage from private outlets.

Of the 29 sources of industrial wastes, two require the construction of new treatment works, and the requirements at one source is undetermined, and no projects are required of 26 sources at the present time.

Table H_{19} shows that no formal action has yet been taken to require construction of treatment works at the six sources of pollution that require projects to abate pollution.

Municipalities and Industries Requiring Improvements to Abate Pollution

The municipalities and industries that require improvements at the present time to abate pollution are listed in Table I_{19}. The names of municipalities are given, but the names of firms are excluded in accordance with the policies or laws of several of the New England States. Instead, the type of wastes, location of sources, and receiving streams are given.

Table B_{19}. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	0
Producing organic wastes	28	Undetermined
Producing inorganic wastes	1	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	29	—

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_{19}.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	0	0	0
Secondary	0	0	0
No treatment	7	0	10,630

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

Table D_{19}. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products................	27	0	27	0
Textile mill products................	0	--	--	--
Lumber and wood products................	0	--	--	--
Paper and allied products................	1	0	1	0
Chemical and allied products........	0	--	--	--
Products of petroleum and coal................	0	--	--	--
Rubber products...........	0	--	--	--
Leather and leather products................	0	--	--	--
Primary metal industries.............	0	--	--	--
Fabricated metal products...............	1	0	1	0
Miscellaneous............	0	--	--	--
Total..................	29	0	29	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_{19}. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	0[1]	--	--	--	--	--	--
Industrial	0[2]	--	--	--	--	--	--

[1] Three small villages, with private sewer outlets serving a total of 230 persons, dispose of domestic wastes by dilution, considered a satisfactory method for the present.

[2] Twenty-six manufacturing plants dispose of process wastes by dilution, considered a satisfactory method of disposal for the present.

Table F_{19}. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	0	--	0	--
1948	0	--	0	--
1949	0	--	0	--

Table G_{19}. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	4	10,400	2
Enlargement or additions to existing plant	0	0	0
Replace existing plant	0	0	0
No project required	3[1]	230	26[2]
Undetermined	0	0	1

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] Three small villages with private sewer outlets dispose of domestic wastes by dilution, considered satisfactory for the present.

[2] 26 industries dispose of process waste, by dilution, considered satisfactory for the present.

Table H_{19}. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	4	2
Abatement ordered	0	0
Plans under preparation	0	0
Final plans approved	0	0
Construction awaiting financing	0	0
Under construction	0	0
Status undetermined	0	1

Table I_{19}. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
		MAINE MUNICIPALITIES		
St. Croix River	Municipal	Baileyville	1,200	New plant
do	do	Calais	4,000	do
Pennamaquan River	do	Eastport	3,100	do
Atlantic Ocean	do	Lubec	2,100	do
		MAINE INDUSTRIES WITH INDUSTRIAL WASTES		
St. Croix River	Pulp and paper	Baileyville	N	New Plant
do	Fish industry	Robbinston	N	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = Information not available.

ST. JOHN RIVER SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The St. John River Sub-Basin drains about 7,200 square miles of northern Maine and 18,800 square miles of southeastern Canada. The river rises in the mountains of northwestern Maine and flows in a northeasterly, then southeasterly, direction a distance of 450 miles where it enters the Bay of Fundy. About 160 miles of the length of the river is in the United States and about 70 miles of this forms the international boundary line between the United States and Canada.

The sub-basin is predominantly a plateau region with two-thirds of the area at an elevation of 1,000 feet or more. The topography of the sub-basin is typically glacial. The geological formations are predominantly limestone and slate overburdened with glacial drift and clays. More than three-fourths of the region is covered with heavy forest growth, mostly soft woods.

The annual precipitation varies from about 31 inches in the southeastern part of the sub-basin in the United States to about 36 inches in the northeastern region, these amounts being generally less than the average for New England. The average winter temperatures are 5° to 15° F. and summer temperatures are 60° to 65° F., the lower figures applying to areas distant from the ocean.

The St. John River has three principal tributaries in Maine: the Allagash, Fish and Aroostook Rivers. The average discharge in the Maine portion of the sub-basin over the years of record is 12,380 cubic feet per second, run-off being highest in the area drained by the upper reaches of the St. John River.

Economic Development

Agriculture is the principal occupation and source of income in the sub-basin in Maine. The sub-basin includes almost all of Aroostook County which has long led the country in the production of potatoes, and this crop accounts for about 90 percent of the farm income. The value of all farm products sold in 1945 is estimated to have been about $50,000,000.

There has not been much manufacturing development in the sub-basin. There has been some manufacturing in which forest products are utilized, particularly the pulping of wood. In recent years the manufacture of starch from surplus potatoes has become an important seasonal activity in Aroostook County. There were fewer than 5,000 persons employed in less than 100 manufacturing establishments in 1947.

The vast wilderness of the sub-basin offers unusual opportunities for all types of recreation. Vacationists in increasing numbers will undoubtedly visit the area as transportation facilities are extended.

The estimated 1950 population of the sub-basin is slightly more than 100,000 persons.

Uses of Water Resources

Practically every legitimate water use is made of the St. John River Sub-Basin resources. The principal uses are for domestic water supply, all types of recreational activities, process waters for manufacture, the transportation of forest products to mills, habitat for wildlife and agricultural uses. The conservation of the water resources for transporting forest products to points of use is considered a serious problem.

POLLUTION DATA

Damages to Water Resources from Pollution

Damages to the water resources have been confined mostly against downstream use for recreational bathing. Below the village of Frenchville, Daigle Brook and Bourgoin Brook have been damaged for use as domestic water supply. Below Caribou the Aroostook River is unsuitable for downstream uses of industrial water supply and game fishing.

Most of the water resources are considered to be suitable for their normal uses. The greatest damages result from the discharge of untreated domestic sewage and potato starch wastes.

Sources of Municipal and Industrial Pollution

Data on the sources of municipal and industrial pollution are summarized in Table A_{20} and B_{20}. Twenty-one communities and schools discharge sewage, and of these, five provide treatment although two plants are unsatisfactory. One military installation discharges primary treatment effluent. In addition two manufacturing plants discharge untreated employee sewage.

A total of 28,547 persons are served by the sewerage facilities at the 24 sources of pollution. The population equivalent of the sewage discharged to watercourses from 20 sources serving 8, 247 persons is estimated to be 7, 470. Four sources of sewage pollution serving 20, 300 persons have inadequate or unavailable data from which to compute pollutional load.

The water resources receive pollution from 32 sources of industrial wastes. All of the wastes are organic in nature. The amount of pollution contributed by industrial wastes cannot be determined from the data available. No sources of inorganic pollution are known to exist in the sub-basin.

The discharge of large volumes of potato starch wastes in the Aroostook River, and pulp and paper wastes in the St. John River from Canadian mills, are the main sources of industrial waste pollution and present the most serious industrial waste pollution abatement problems in the sub-basin.

Existing Municipal and Industrial Treatment Facilities

Tables C_{20} and D_{20} summarize the existing municipal and industrial treatment facilities. The sewage from five sources serving 6, 370 persons receives primary treatment and the sewage from 19 other sources serving 21, 177 persons receives no treatment.

There are 32 industrial establishments that discharge process wastes to the streams, none of which receives any treatment.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Table E_{20} shows that the adequacy with relation to capacity and operation of the five sewage treatment plants in operation has not been determined. There are no industrial waste treatment plants in operation.

Table G_{20} lists the requirements for municipal and industrial waste treatment plants in abating pollution. Of the 24 sources of sewage pollution, 13 require new plants to serve 21, 560 persons, two existing plants serving 5, 600 persons require additions, and no project is required at three of the existing treatment works known to be satisfactory and at six other sources now disposing of sewage by dilution which is considered adequate disposal for the present.

Twenty-six sources of industrial waste pollution require new treatment plants and the requirements of the other six are undetermined.

The status of treatment works projects to abate pollution is shown in Table H_{20}. Of the total of 56 sources of pollution the status of six is undetermined and no formal action has been taken against the remaining 41 sources.

Municipalities and Industries Requiring Improvements to Abate Pollution

Table I_{20} is a list of the sources of sewage and industrial waste pollution requiring improvements for abatement of pollution. The names of municipalities are given, but the names of firms are excluded in accordance with the policies or laws of several of the New England States. Instead, the type of waste, location and receiving stream are given.

Table A_{20}. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	20[1]	8,247	7,470
Having population data available (Data on pollution load to watercourse incomplete or not available)	4	20,300	Not applicable.
Total	24	28,547	—

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

[1] 2 industries discharge sanitary wastes only, 122 employees.

Table B_{20}. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	0
Producing organic wastes	32	Undetermined
Producing inorganic wastes	0	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	32	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_{20}.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	5	5	6,370
Secondary	0	0	0
No treatment	19[1]	0	23,177

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary district, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

[1] Includes 2 industries having sanitary sewage only from 122 employees.

Table D_{20}. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products..	31	0	31	0
Textile mill products......	1	0	1	0
Lumber and wood products...	0	--	--	--
Paper and allied products...............	0	--	--	--
Chemical and allied products...............	0	--	--	--
Products of petroleum and coal...................	0	--	--	--
Rubber products............	0	--	--	--
Leather and leather products...............	0	--	--	--
Primary metal industries...	0	--	--	--
Fabricated metal products..	0	--	--	--
Miscellaneous..............	0	--	--	--
Total..................	32	0	32	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_{20}. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	5[1]	0	0	5	0	0	5
Industrial	0	--	--	--	--	--	--

[1] The adequacy with relation to capacity and operation were reported as undetermined; further, 2 plants are known to require additions before treatment is satisfactory; 3 plants are considered to be satisfactory for the present.

Table F_{20}. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	0	--	0	--
1948	0	--	0	--
1949	0	--	0	--

Table G_{20}. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	13	21,560	26
Enlargement or additions to existing plant	2[1]	5,600	0
Replace existing plant	0	0	0
No project required	9 [2] [3]	1,387	0
Undetermined	0	0	6

* The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] 2 municipalities with treatment plants, of undetermined design and operation, known to require additions.

[2] 3 municipalities with treatment plants of undetermined design and operation considered to provide adequate treatment for the present.

[3] 5 municipalities with private sewers and one industry with sanitary sewage only dispose of sewage by dilution, adequate disposal for the present.

Table H_{20}. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	15	26
Abatement ordered	0	0
Plans under preparation	0	0
Final plans approved	0	0
Construction awaiting financing	0	0
Under construction	0	0
Status undetermined	0	6

Table I_{20}. Project list - municipalities and industries requiring improvements for abatement of pollution*, September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
MAINE MUNICIPALITIES				
St. John R.	Municipal	Ft. Kent	475	New plant
do	do	Madawaska	2,600	do
do	do	Van Buren	6,000	do
Daigle Brook	School	Frenchville	200	do
Bourgion Brook	do	do	200	do
Aroostook River	Municipal	Caribou	2,800	do
do	do	Ft. Fairfield	700	do
Salmon Brook	do	Washburn	600	Add to existing plant
Presque Isle Stream	do	Mapleton	75	New plant
do	do	Presque Isle	5,000	Add to existing plant
Bryant Brook	do	Ft. Fairfield	300	New plant
Limestone Str.	do	Limestone	600	do
Prestile Str.	do	Mars Hill	1,000	do
Meduxnekeag River	do	Houlton	6,500	do
MAINE INDUSTRY WITH SANITARY SEWAGE ONLY				
Meduxnekeag River	Plywood manufacturing	Houlton	110	New plant
MAINE INDUSTRIES WITH INDUSTRIAL WASTES				
St. John River	Starch manufacturing	Grand Isle	N	New plant
do	Creamery	do	N	do
do	do	Van Buren	N	do
Fish River	Starch manufacturing	Ft. Kent	N	do
do	do	do	N	do
Long Lake	do	St. Agatha	N	do
do	do	Long Lake	N	do
Machias River	do	Ashland Village	N	do
Salmon Brk.	Potato processing	Washburn	N	do
Presque Isle Stream	Starch manufacturing	Mapleton	N	do
do	do	Presque Isle	N	do
Caribou Str.	do	Woodland	N	do
do	Woolen mill	Caribou	N	do
Gray Brook	Starch manufacturing	Ft. Fairfield Center	N	do
Hockenbull Br.	do	do	N	do
Pattee Brook	do	do	N	do
Limestone Str.	do	Limestone	N	do
do	do	do	N	do
Goodrich Br.	do	Goodrich Brook	N	do
Prestile Str.	do	Westfield	N	do
do	do	Mars Hill	N	do
Unnamed Stream	Pea processing	Nr. Junction with Prestile Str.	N	do
Meduxnekeag River	Starch manufacturing	Houlton	N	do
do	Pea processing	do	N	do
do	do	do	N	do
N. Branch Meduxnekeag River	Starch manufacturing	Monticello	N	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = Information not available or does not apply.

LAKE MEMPHREMAGOG SUB-BASIN

GENERAL DESCRIPTION

Physical Description

Lake Memphremagog is an international lake about 25 miles long and three miles wide and nearly four-fifths of the lake proper lies in Canada. The Lake Memphremagog Sub-Basin drains an area of approximately 575 square miles of north central Vermont. The lake is drained by the Magog River in Canada and via the St. Francis River is eventually tributary to the St. Lawrence River. East of the lake there are several small streams that drain a portion of the sub-basin and are also tributary to the St. Francis River. The drainage area is comparatively level and contains numerous other lakes as well as Lake Memphremagog.

Rock formation in the sub-basin is mixed sandstone, limestone, slate and schist. There are heavy deposits of clay in the lowlands over which has been deposited a clay loam. Within this sub-basin is contained the most highly developed pasture lands in New England. To the east of Lake Memphremagog is an area of about 125 square miles of comparative wilderness.

Annual precipitation is considerably less than the average for New England, being about 36 inches. Most precipitation occurs during the five months of June through October. Temperatures vary somewhat with altitude, but in general summer temperatures average 66°F. and winter temperatures average about 20°F. A gaging station is maintained on the Clyde River and records indicate that the total run-off in the sub-basin averages annually some 1,000 cubic feet per second.

The 1950 population of the sub-basin is estimated to be 21,000. The largest city in the area is Newport with an estimated 1950 population of 5,400.

Economic Development

The Lake Memphremagog Sub-Basin is primarily a rural area. Agriculture is by far the principal source of income in the sub-basin. Very little general crop farming is done and most of the farms are in pasture. It is a highly developed dairying area, and the sale of dairy products accounts for more than 80 percent of the total farm revenue. Other livestock products and poultry account for most of the remaining farm income. The value of all farm products sold during 1945 was an estimated $6,500,000.

There is very little industry in this sub-basin. Such manufacturing as is practiced is fairly well diversified though small. Manufacturing is represented in foods, textile mill products, lumber and allied products, furniture, chemicals, machinery and stone, clay and glass products. There are an estimated 30 manufacturing plants in the sub-basin that employed 1,300 persons in 1947. The total wages paid all manufacturing employees during that year was about $2,370,000 and the value added to products by manufacture was some $4,300,000.

Recreation is being developed as an industry in this sub-basin. The region has many natural advantages for this type of development. Competition from the nearby Lake Champlain recreational area and distance from population centers has probably retarded recreational development in the past.

Uses of the Water Resources

Being a primarily rural area there has not been an extensive use of the water resources. Principal uses are for livestock watering, wildlife habitat, game fishing, some recreational uses and miscellaneous other uses such as transportation of wastes.

POLLUTION DATA

Damages to Water Resources from Pollution

There have been no damages to the limited uses made of the water resources of the Lake Memphremagog Sub-Basin.

Sources of Municipal and Industrial Pollution

Tables A_{23} and B_{23} summarize the sources of pollution in the sub-basin. There are a total of 13 separate sources, of which eight, with a contributing population of 7,600 discharge sewage and five discharge organic industrial wastes.

Existing Municipal and Industrial Treatment Facilities

None of the 13 sources of pollution has been provided with treatment facilities as is shown by Tables C_{23} and D_{23}.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Tables F_{23}, G_{23} and H_{23} are self-explanatory. There are no existing treatment plants, the requirements for pollution abatement have not been determined, and no action has been taken to determine requirements, if any, to abate pollution.

Since the requirements, if any, to abate pollution have not been determined, Table I, which under the other sub-basins listed the communities and industries requiring improvements, is omitted for this sub-basin. Tables A_{23} through H_{23} follow.

Table A_{23}. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	6	5,235	6,085
having population data available (Data on pollution load to watercourse incomplete or not available)	2	2,400	Not applicable
Total	8	7,635	--

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

Table B_{23}. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	3	375
Producing organic wastes	2	Undetermined.
Producing inorganic wastes	0	Not applicable.
Producing wastes of undetermined type	0	Undetermined.
Total	5	--

*Industries having seperate outlets and discharging wastes directly to watercourse.

Table C_{23}.
Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	0	--	0
Secondary	0	--	--
No treatment	8	0	7,635

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

Table D_{23}. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products.................	3	0	3	0
Textile mill products.................	0	--	--	--
Lumber and wood products.................	2	0	2	0
Paper and allied products.................	0	--	--	--
Chemical and allied products.................	0	--	--	--
Products of petroleum and coal.................	0	--	--	--
Rubber products............	0	--	--	--
Leather and leather products.................	0	--	--	--
Primary metal industries................	0	--	--	--
Fabricated metal products.................	0	--	--	--
Miscellaneous..............	0	--	--	--
Total.....................	5	0	5	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_{23}. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0

Table F_{23}. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	0	--	0	--
1948	0	--	0	--
1949	0	--	0	--

Table G_{23}. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	0	0	0
Enlargement or additions to existing plant	0	0	0
Replace existing plant	0	0	0
No project required	0	0	0
Undetermined	8	7,365	5

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

Table H_{23}. Status of treatment works projects to abate pollution, September, 1950

Status of project	Number	
	Municipal	Industrial
No formal action	0	0
Abatement ordered	0	0
Plans under preparation	0	0
Final plans approved	0	0
Construction awaiting financing	0	0
Under construction	0	0
Status undetermined	8	5

LAKE CHAMPLAIN SUB-BASIN

GENERAL DESCRIPTION

Physical Description

The Lake Champlain Sub-Basin in Vermont comprises all of the area west of the Lake Memphremagog and Connecticut River Sub-Basins and north of the Batten Kill Sub-Basin. In New York it drains all of the area north and east of the Hudson River Sub-Basin. There are five principal rivers in the New York portion -- the Bouquet, Ausable, Saranac, Little Chazy, and Great Chazy Rivers. In Vermont there are also five important rivers in the Champlain Sub-Basin -- Otter Creek and the Poultney, Winooski, Lamoille and Missisquoi Rivers. There are many other smaller watercourses having drainage areas of less than 90 square miles. Lake Champlain and the Poultney River form the New York-Vermont boundary line for a distance of about 120 miles. The lake empties into the Richelieu River in Canada just north of the international border. The drainage area of the sub-basin totals about 5,000 square miles.

The eastern watershed of the Champlain Sub-Basin is high, irregular mountainous country. The most famous of the mountain ranges in this sub-basin are the Green Mountains. The so-called Champlain Valley is low, rolling country and an excellent agricultural area. Rock formation in the Green Mountains area is granite. To the west of the Green Mountains, marble predominates and in the lowlands rock formation is a mixture of sandstone, limestone, slate and schist. In the fertile valleys the topsoils are a clay loam.

Precipitation is somewhat lower than the average for other parts of New England, averaging about 36 inches per year. Temperatures vary with the altitude but in general, summer temperatures average near 66°F. and winter temperatures average about 20°F. There are a number of stream gaging stations in the sub-basin and the records on the principal streams indicate the total run-off in the Champlain Sub-Basin to average about 8,750 cubic feet per second annually.

Economic Development

The Lake Champlain Sub-Basin is primarily a rural area and agriculture is the main source of income. In the Champlain Valley the chief agricultural pursuits are dairying, potato and fruit growing, and there is some general farming. In the more mountainous regions farming is generally limited to dairying and the maple sugar industry. The value of all farm products sold during 1945 was an estimated $49,000,000 and some $37,000,000 of this was represented by the sale of dairy products.

Although the sub-basin is primarily an agricultural region there has been an appreciable industrial development. The principle products manufactured are lumber and allied goods, apparel, paper, and clay, stone and glass products. During the year 1947 manufacturing activities provided employment for an average of nearly 20,300 persons in 550 plants. The total wages paid all manufacturing employees during that year was approximately $65,000,000 and the value added to products by manufacture was some $94,000,000. Industry has shown a steady growth in the Champlain Sub-Basin.

Recreation is a very important industry to the general economy of Vermont. The Lake Champlain area is very popular with vacationists and summer residents. Hundreds of summer homes, camps and resorts have been built in the sub-basin and represent a tremendous capital investment. There are several parks and forest reservations and these have also been developed for recreational purposes. The Lake Champlain Sub-Basin is Vermont's most valuable recreational asset and is one of New York's important recreational centers.

The preliminary releases of 1950 population figures indicate the present population of the Lake Champlain Sub-Basin to be about 280,000. Burlington, Vt., is the largest city with a reported 1950 population of 33,039. Montpelier, the capital of Vermont, is in Washington County.

Uses of the Water Resources

Almost every legitimate use is made of the water resources of the Lake Champlain Sub-Basin except for commercial fishing and shellfish propagation. The most important and extensive uses are for public and industrial water supply, all types of recreation and for livestock watering. Other important uses are for wildlife habitat and navigation.

POLLUTION DATA

Damages to Water Resources from Pollution

Counting Lake George and Lake Champlain proper, there are 50 lakes, rivers, and streams in the Lake Champlain Sub-Basin that transport pollution. In the majority of these waters, the amount of pollution transported is not sufficient to impair quality for normal uses. In 14 streams, however, the pollution transported has resulted in damages to normal downstream uses. Damages have been greatest to the uses for livestock watering, game fishing, recreational bathing, other recreational uses and wildlife habitat. Stevens Branch on the Winooski River and the Chazy River have also been damaged for use as sources of industrial water supply. The LaPlatte and Chazy Rivers are degraded to nuisance conditions during critical periods of high temperature and low flow.

Sources of Municipal and Industrial Pollution

Tables A_{24} and B_{24} contain data on the sources of municipal and industrial pollution. Of a total of 140 separate sources of pollution, 71 are municipal sources with a total contributing population of 159, 360 persons and 69 are the result of discharging industrial wastes. The total pollutional load has not been determined but indications are that the population equivalent is well over 200, 000.

Existing Municipal and Industrial Treatment Facilities

Of the total of 140 separate sources of pollution, treatment facilities have been provided at 21 sources. The sewage from 46, 200 persons receives treatment as does industrial wastes from five manufacturing establishments. The sewage from some 113, 000 persons and the industrial waste from 64 industries is discharged to watercourses without treatment. These and other data are given in Tables C_{24} and D_{24}.

Progress in Pollution Abatement and Status of Present and Required Treatment Facilities

Ten of the 16 existing sewage facilities are providing satisfactory treatment and two are inadequate in capacity. The status of four sewage treatment works is undetermined. None of the five industrial waste treatment plants is satisfactory, three are inadequate in capacity and the status of two is undetermined. These data are summarized in Table E_{24}.

Tables G_{24} and H_{24} show the requirements for and status of treatment works projects. Sixteen new sewage plants to serve 60, 500 persons are needed and additions to three existing plants serving 31, 600 persons are required. No project is required for ten satisfactory sewage treatment plants and the requirements for 43 other sources serving 53, 500 persons have not been determined. Seventeen new industrial waste treatment facilities are required, three existing industrial waste plants need additions and the requirements for 49 sources of industrial waste pollution have not been determined.

No formal action has been taken to require abatement of pollution at 17 sources of sewage pollution and 20 sources of industrial waste pollution. Final plans have been approved for projects to abate two sources of sewage pollution. The status of requirements for 43 sources of sewage and 49 sources of industrial waste pollution have not been determined.

Municipalities and Industries Requiring Improvements to Abate Pollution

A list of the sources of pollution requiring improvements to abate pollution is given in Table I_{24}. The names of manufacturing firms have been omitted in accordance with the policies or laws of several of the New England States.

Table A_{24}. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	54	72,910	50,955
Having population data available (Data on pollution load to watercourse incomplete or not available)	17	86,450	Not applicable.
Total	71	159,360	—

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

**Includes industrial wastes discharged into municipal sewerage systems.

Table B_{24}. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	26	13,175
Producing organic wastes	36	Undetermined
Producing inorganic wastes	7	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	69	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table C_{24}. Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	12	12	35,980
Secondary	4	4	10,245
No treatment	55	0	113,135

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers, and industries discharging sanitary sewage wastes directly to watercourse.

Table D_{24}. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products....................	37	1	36	0
Textile mill products....................	6	0	6	0
Lumber and wood products....................	9	0	9	0
Paper and allied products....................	6	1	5	0
Chemical and allied products....................	0	--	--	--
Products of petroleum and coal...............	1	0	1	0
Rubber products...........	0	--	--	--
Leather and leather products.................	0	--	--	--
Primary metal industries..................	2	1	1	0
Fabricated metal products....................	1	0	1	0
Miscellaneous............	7	2	5	0
Totals..............	69	5	64	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_{24}. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	16	10	2	4	11	0	5
Industrial	5	0	3	2	1	2	2

Table F_{24}. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	--	0	--
1947	0	--	0	--
1948	0	--	0	--
1949	0	--	0	--

Table G_{24}. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	16	60,500	17
Enlargement or additions to existing plant	3[1]	31,590	3
Replace existing plant	0	0	0
No project required	10[1]	13,785	0
Undetermined	43	53,485	49

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

[1] One sewage treatment plant is adequate in capacity and operation but requires an extension of the outfall sewer into deeper water for satisfactory disposal of effluent. Plant is therefore listed under "Additions to existing plant" and also under "No project required."

Table H_{24}. Status of treatment works projects to abate pollution, September 1950

Status of project	Number	
	Municipal	Industrial
No formal action	17	20
Abatement ordered	0	0
Plans under preparation	0	0
Final plans approved	2	0
Construction awaiting financing	0	0
Under construction	0	0
Status undetermined	43	49

Table I_{24}. Project list - municipalities and industries requiring improvements for abatement of pollution,* September 1950

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
VERMONT MUNICIPALITIES				
Lake Champlain	Municipal	Burlington	20,000	New plant
Otter Creek	do	Brandon	1,400	do
Winooski River	do	Montpelier	7,500	do
Lake Champlain	do	Burlington	7,000	do
Winooski River	do	Barre	9,900	do
Stevens Brk.	do	St. Albans	8,100	Enlargement existing plant
Missisquoi River	do	North Troy	500	New plant
VERMONT INDUSTRIES WITH INDUSTRIAL WASTES				
Otter Creek	Milk products manufacturing	Vergennes	N	New plant
LaPlatte River	Cheese plant	Hinesburg	N	do
Winooski River	do	Cabot	N	do
do	Woolen mill	Winooski	N	do
do	Packing house	Worcester	N	do
do	Saw mill	Moretown	N	do
Lamoille River	Milk company	E. Hardwick	N	do
do	Gravel washing plant	Johnson	N	Enlarge existing plant
Missisquoi River	Cheese plant	Troy	N	New plant
do	do	do	N	do
Mill River	Milk plant	E. Wallingford	N	do
NEW YORK MUNICIPALITIES				
George and Champlain Lakes	Municipal	Whitehall	4,900	New plant
do	do	Ticonderoga	3,000	do
do	do	Port Henry	1,900	do
do	do	Westport	700	do
do	do	Rouses Point	1,800	do
Ausable River	Private sewers	Ausable Forks	500	do
do	do	Keeseville	300	do
do	do	North Elba	200	do
Saranac River	Municipal	Saranac Lake	7,140	Add to existing plant
Lake Champlain	do	Plattsburg	16,350	do
Saranac River	do	Bloomingdale	400	New plant
Chazy River	do	Champlain	500	do
NEW YORK INDUSTRIES WITH INDUSTRIAL WASTES				
George and Champlain Lakes	Paper manufacturing	Ticonderoga	N	Add to existing plant
do	Iron ore processing	Port Henry	N	New plant
do	Paper manufacturing	Plattsburg	N	do
Mill Brook	Steel plant	Port Henry	N	Add to existing plant

See footnotes at end of table

Table I_{24}. Project list - municipalities and industries requiring improvements for abatement of pollution,* September 1950 --Continued

Receiving stream	Source of pollution	Location	Population served or equivalent number people**	Project requirements
Bouquet River	Pulp and paper mill	Willsboro	N	New plant
West Branch Ausable River	do	Ausable Forks	N	do
Saranac River	Paper manufacturing	Plattsburg	N	do
do	Public utility	do	N	do
Chazy River	Creamery	Champlain	N	do

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**N = Information not available or does not apply.

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